JANUARY 1955

The Paper Industry

Upgrading through Bleaching

In the next 4 years...

Will your condensate return lines

Look like this . . .
Section of condensate line, removed after four years of plant service, shows excellent corrosion protection obtained with Nalco 35.

. . . Or like this?
In the four years before Nalco 35 was used, untreated condensate lines in the same plant were seriously damaged by corrosion and pitting.

TWO Nalco METHODS FOR POSITIVE CONDENSATE CORROSION PREVENTION

1 Nalco 35 PREVENTS CORROSION BY pH CONTROL

Nalco 35 controls pH in the condensate return system... neutralizes carbon dioxide to assure corrosion prevention. Especially recommended for low make-up systems, Nalco 35 vaporizes and condenses with the steam, *and at the same rate.* Uniform treatment concentration is assured throughout the system; and long-lasting Nalco 35 makes positive return-line, tank, and valve protection a real operating economy.

2 Nalco 35 FM PREVENTS CORROSION BY PROTECTIVE FILM

Nalco 35 FM protects metals in steam systems by forming a tough, rustproof microscopic film on all exposed surfaces. Corrosive gases and liquids cannot reach the metal surface to cause damage.

Nalco 35 FM is fed with a low-cost Nalco condenser-feeder, or any good chemical pump, directly into steam or condensate lines. Once your steam system has protection of Nalco 35 FM film, low dosages maintain film permanently.

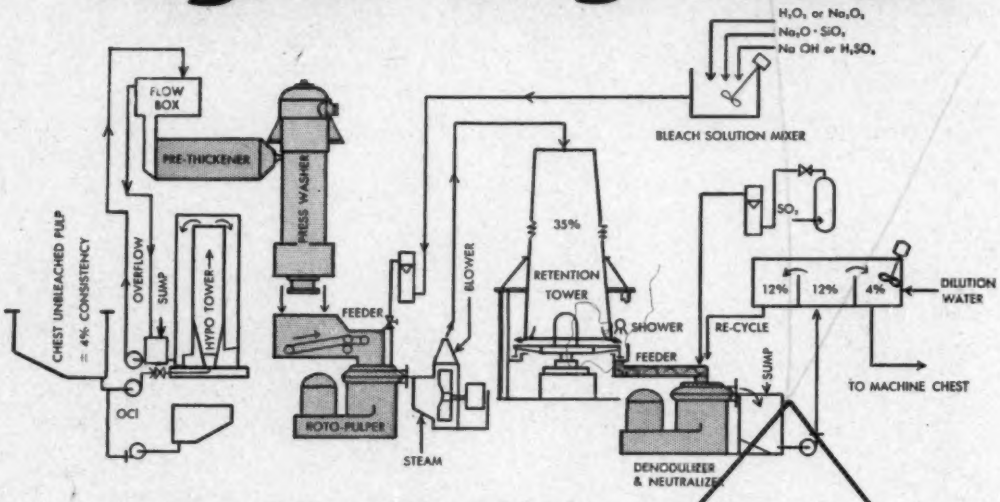
NATIONAL ALUMINATE CORPORATION
6232 W. 66th Place • Chicago 38, Illinois
In Canada: Alchem Limited, Burlington, Ontario

THE Nalco® SYSTEM . . . Serving Industry through Practical Applied Science

now you can have both...

lower cost

higher brightness



in the new J-C groundwood bleaching system!

For four years J-C's single stage groundwood bleaching system has provided high brightness at reduced costs for various mills.

Now a new and better process . . . the dual-stage system . . . has been perfected by J-C engineers to give outstanding savings in chemical consumption and greater increases in brightness.

Look over this list of reasons and see for yourself how this new process produces a better product at a far lower cost.

fully continuous, precision controlled system
low initial investment
much lower operating costs per ton
minimum floor space
sharply reduced yield loss
maximum brightness
minimum color reversion
unchanged pulp physicals
one operator per shift
freedom from knots and "fish eyes"

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Work well done since eighty-one

You don't have to be a Shakespeare to get in this book!

?

All pulp and paper mill employees are eligible to win one of the **three national prizes** of $1,000, $750 and $500, or one of the **ten divisional** prizes of $100 each.

?

By writing a paper on the subject, **"The Value of Better Mill Communications,"** of 1500 words or less, typed double spaced, on 8½" x 11" sheets. Cover sheet only to include: name, name and location of mill, and position or duties.

?

Now. All papers must be postmarked before midnight March 31, 1955. Mail to Secretary and Treasurer, The American Pulp and Paper Mill Superintendents Association, 327 So. La Salle St., Chicago 4, Illinois.

Annual Bolton Award Essay Contests are sponsored by **The American Pulp and Paper Mill Superintendents Association.** *The 13 prize-winning papers are published in bound volumes for free distribution "to foster an exchange of ideas on matters of common interest to all persons engaged in the pulp and paper industry."*

But there's $3,250 in it for those who do!

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The Paper Industry

Technology • Engineering • Management • Production

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bull's-eye for quality

This huge calciner represents just one step in the TITANOX quality story. In this mammoth rotary kiln, titanium hydrate is converted to titanium dioxide. Here are developed, through careful heat treatment, the unique optical properties of TITANOX pigments—unsurpassed whitening, brightening and opacifying power.

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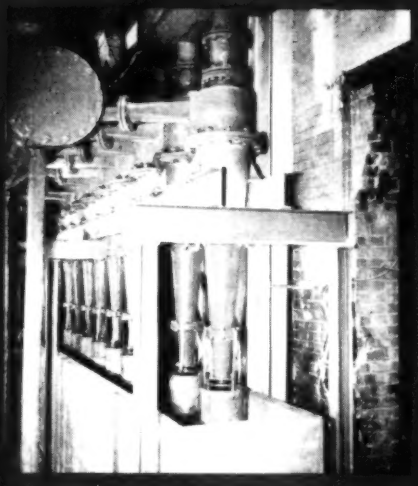


Bauer

BAUER CLEANERS

remove more than soil and sand

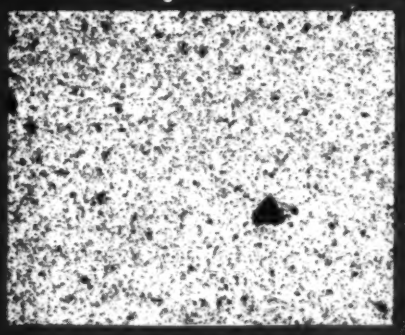
Since particles of high specific gravity naturally settle from water suspensions, their removal from pulp slurry is easy. But Bauer Cleaners recognize other kinds of debris in pulp—particles of different *shape* than fibers.

So the rejects from Bauer Cleaners are not only soil and sand, but also pieces of bark, shives, slivers, and miscellaneous refuse.

You can readily see these dregs in sheets made from Bauer Cleaner rejects. We'll be glad to show you a number of samples, as well as sheets made from accepted stock. The evidence is amazing.

Photograph shows a hand sheet made from Bauer Cleaner final rejects. Feels like sandpaper!

Ask to see samples. The coupon can be used.



THE BAUER BROS. CO.

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Show me sample sheets made from Bauer Cleaner rejects and accepted stock.

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(Individual and Title)

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(Company)

_____
(Street Address or Box)

_____
(City, Zone, State)

10,800 cu. ft. of cooking vessels...

Four
HORTON Digesters

This view shows four 2700 cu. ft. digesters being erected for the direct cooking of wood chips by the sulphate process.

These digesters were built by the Chicago Bridge & Iron Company from A-285 Grade C steel. They were designed for an operating pressure of 150 lbs. per sq. in. and temperatures up to 650 deg. Fahr. Each vessel was X-rayed and stress-relieved before shipment.

Chicago Bridge & Iron Company designs, fabricates and erects sulphate and sulphite digesters for use in every pulp mill area of the country. Write our nearest office for estimates or quotations on digesters, storage tanks or other steel plate structures you may need. There is no obligation.

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style 200
CLIPPER SEAMS
cut
DRYER FELT
costs

Stronger than conventional clipper seams—particularly effective on high speed machines, or machines with small diameter felt rolls. Ask for sample.

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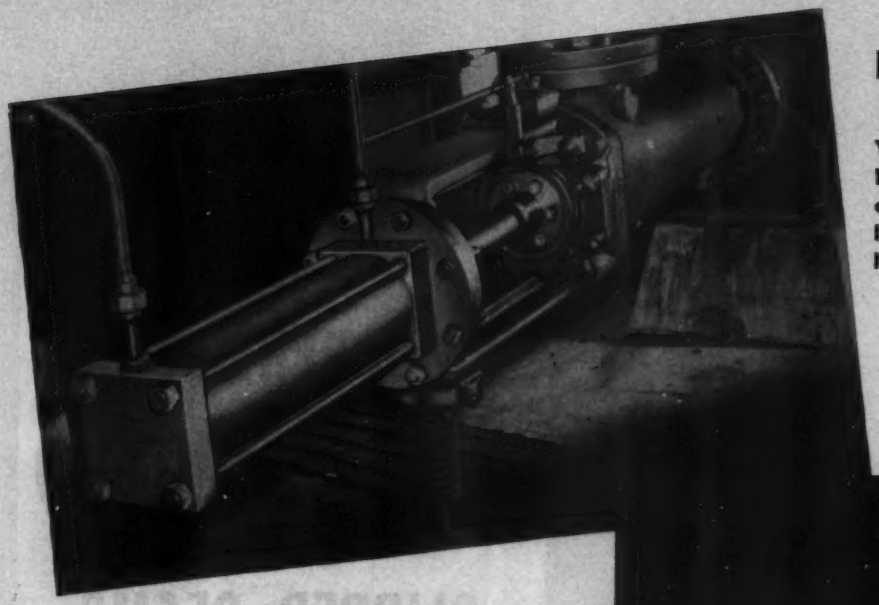

HYDRAULIC-OPERATED

Yarway Digester Blow Valve—one of six installed at large North Carolina paper mill.

MOTOR-OPERATED

Yarway Digester Blow Valve—one of eight installed at large Canadian paper mill.

You can choose between hydraulic-operation and motor-operation when you specify Yarway Digester Blow Valves. Both combine all the following Yarway advantages:

- Remote control, usually from above, on the operating floor.
- Tight shut-off. Effective sealing under full digester pressure. Saves cooking liquor. Insures thorough pulp cooking.
- Free discharge. No pockets. Full discharge with minimum pressure drop. Digester blows clean.
- Rugged construction. Built to withstand shock and wear of toughest service.
- Modern metallurgy—such as sliding plunger of hardened stainless steel and sleeve of chromium nickel—resists wear and chemical action.

For full details, write for Yarway Bulletin B-440.

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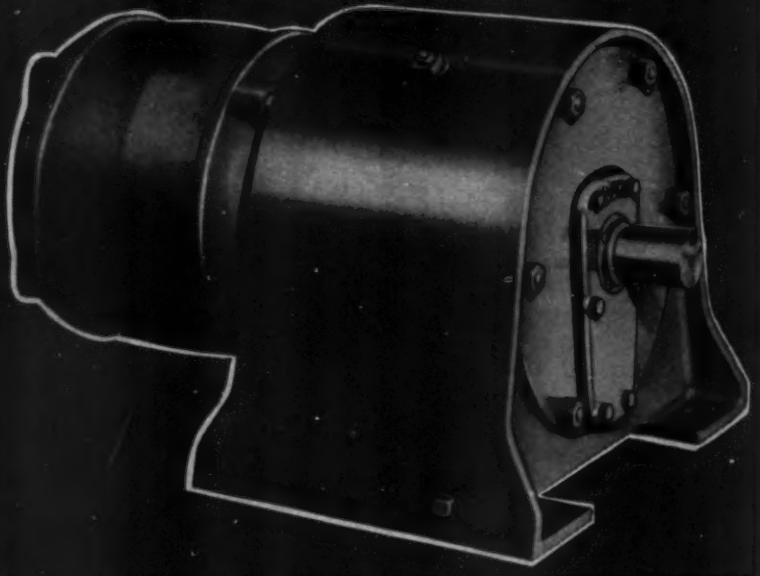
DIGESTER BLOW VALVES

-Newly Designed- **Integral**

oreducer

(Gearmotor Type–Supplementing Falk All-Motor Line)

. . . with completely standard round-frame, D-flange motor



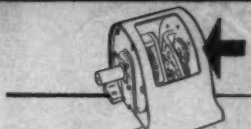
Check and Compare these features...

Meet a faithful old friend in a new, modern dress! The famous, time-proved Integral Type *all-steel* Falk Motoreducer (Supplementing Falk All-Motor Line) has been redesigned into a compact, streamlined unit providing the utmost in space economy—but retaining all the application versatility, long-life performance, easy-maintenance features and superior structural qualities that have made Falk Motoreducers the recognized standard throughout industry.

In this new Integral unit—rated in accordance with AGMA standards—a *completely standard* round-frame, D flange NEMA motor is mounted directly on the all-steel Motoreducer housing. The motor remains a separate piece of equipment, readily replaceable with any other type or make. Output speed (ratio) can be changed within unit's torque capacity without modifying motor. Size and arrangement of the standard housing permit wide ratio range—from 3.36:1 to 542:1

In order to meet the greatest number of industrial application needs, the newly designed Integral Motoreducers are available in horizontal and vertical models, both in concentric and right-angle types; double, triple and quadruple reduction; horsepower range, 1 to 40 HP. Prompt stock shipment in standard ratios is offered.

Whatever your reduction requirements, you get greatest dollar-for-dollar value in the long run by standardizing on Falk products. Write for Bulletin 3104.



Every FALK Motoreducer has these "In-built" Factors—

Precision Gearing. Heat treated alloy steel, precision cut and shaved helical gearing throughout . . . quiet-operating crown shaved pinions . . . taper bored gears for easy ratio changes.

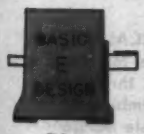
All-steel Housings. Unbreakable, strong, rigid. Generous overhung load capacities provided by wide bearing spans, large shafts and bearings.

Streamlined inside and outside. Smooth, clean surfaces; machine welded construction conforms to NEMA motor frames.

Positive Lubrication. Large sump capacity . . . oil-tight construction assures clean lubricant . . . direct dip of revolving elements provides positive lubrication at all speeds.

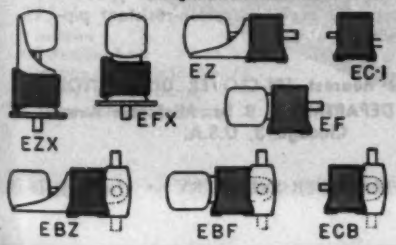
Wide Speed Range. Selective ratio combinations provide output speeds from 1.5 rpm to 1430 rpm with stock gears.

Sealed Housings. Dual closures and one-way vents keep oil *in*, dust and moisture *out*. Units are splash-proof, leakproof, dustproof.



EC

The basic E design permits maximum use of standardized parts . . . closer control over materials, processing, inspection and assembly . . . resulting in faster delivery from interchangeable stocked assemblies.

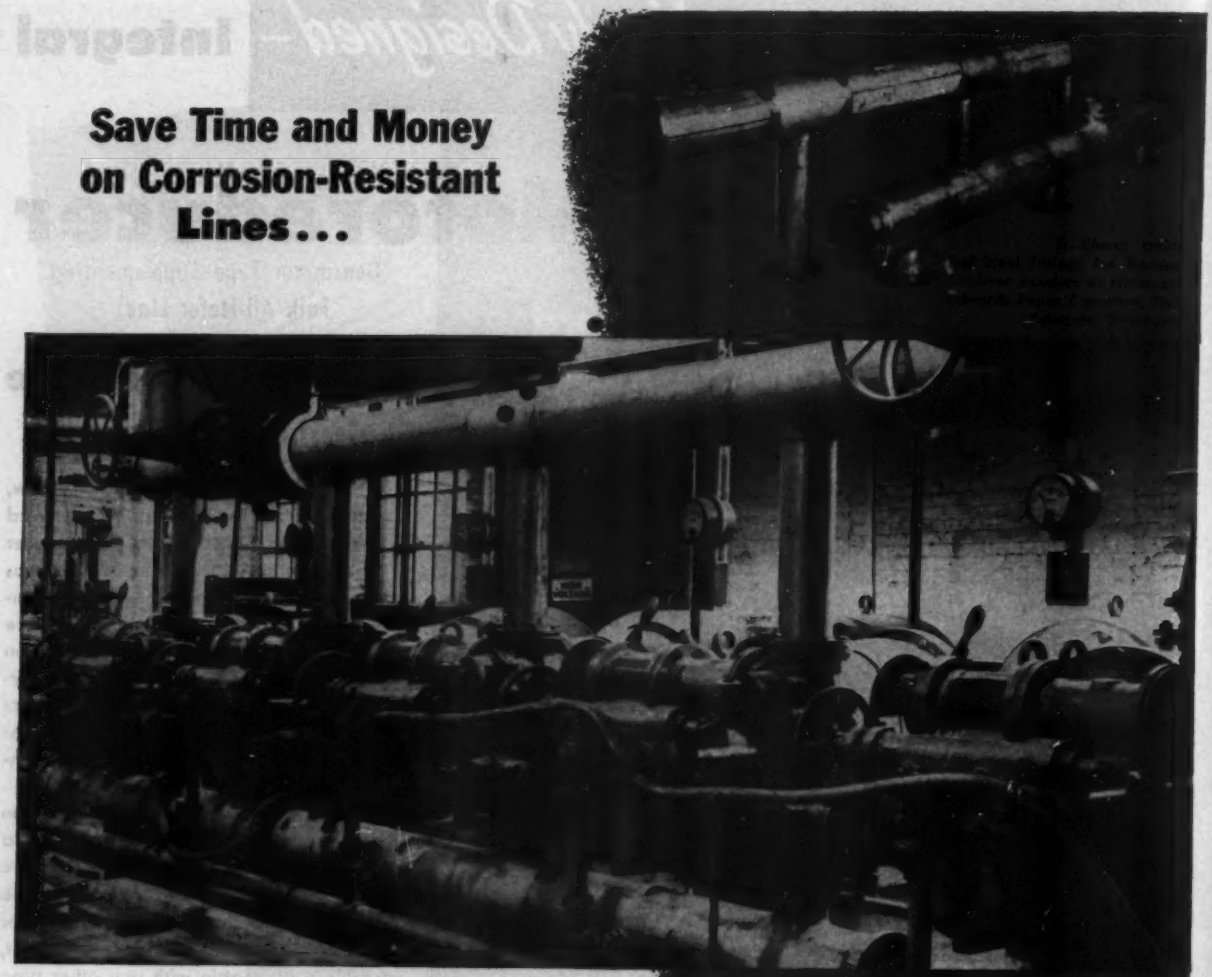


FALK

...a good name in industry

THE FALK CORPORATION · 3001 W. Canal St.· Milwaukee 8, Wis.

Save Time and Money on Corrosion-Resistant Lines...



... with TRI-CLOVER Stainless Steel Fittings

Among the most important factors governing the selection of corrosion-resistant fittings and piping are: (1) The assurance of *full* corrosion-resistance in the actual material; (2) The assurance that the manufacturer has had ample experience and ability in producing a full range of corrosion-resistant material; and (3) assurance that actual costs for installation will be as low as possible, commensurate with the quality of the finished assemblies.

When you specify *TRI-CLOVER* stainless steel fittings, pipe, tubing and pumps you can be *sure* that all of the above factors have been met . . . And you can be *sure* that you are getting *full* corrosion resistance in *every* fitting . . . thanks to Tri-Clover's specialized experience in solving corrosion-resistant piping problems for chemical-process industries from coast to coast.

LADISH CO.
Tri-Clover Division
KENOSHA WISCONSIN

1 354

STAINLESS STEEL CLAMP-TYPE CONICAL FITTINGS . . . requires only two simple ferrules and clamp to assure leak-tight joints thru the use of Teflon gaskets. Fast, simple assembly and disassembly—Just one of the complete range of Tri-Clover Stainless Steel fitting types to meet practically every corrosion-resistant piping requirement.

See your nearest TRI-CLOVER DISTRIBUTOR
EXPORT DEPARTMENT, 8 So. Michigan Ave., Chicago 3, U.S.A.

EBZ EBF ECB

WRITE FOR BULLETIN 2364

How to make a more uniform board . . . for less money

- Provides close, accurate control of wet end fluctuations.
- Measures thickness at several points across sheet.
- Makes corrections by regulating flow of stock but only after a trend has been established.
- Provides a continuous, permanent chart of wet end caliper.
- Signals operator when a drift across the sheet occurs.
- Provides back-tenders and management with a continuous chart record at the dry end.
- Automatically provides warning when slides, crushes, drop-offs, plugged gates, plugged screens or other factors threaten loss of the sheet.

Uniform caliper at the dry end means eternal vigilance at the wet end. It means continuous, automatic measurement at several points across the sheet . . . automatic control of stock flow to compensate for out-of-caliper conditions . . . automatic warning of drift . . . and dependable, unvarying accuracy under all operating conditions. When you have all that, you've got a finished board that's uniform in thickness throughout the run.

The Hurletron Automatic Caliper and Weight Control is doing this job in dozens of mills . . . doing it successfully . . . efficiently. In every case, this equipment is responsible for a more uniform board from start to finish . . . better quality . . . less broke . . . minimum waste of raw stock . . . and greater daily tonnage. No wonder it's a profit maker.

But don't take our word for it. Let us tell you where you can see Hurletron equipment in operation . . . where you can get first-hand information about its accuracy and economy. Just drop us a line. There's no obligation.

HURLETRON Automatic CALIPER and WEIGHT CONTROL

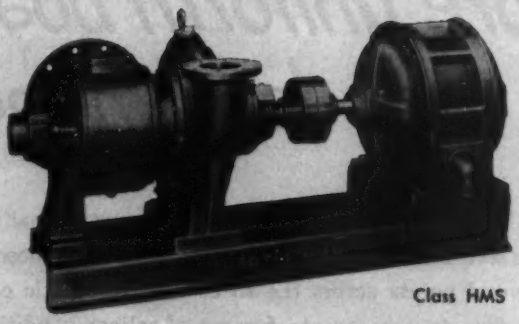
ASK FOR BULLETIN 211
It contains full details about Hurletron Caliper and Weight Controls . . . with charts, diagrams and photographs.

ELECTRIC EYE EQUIPMENT COMPANY
1936 E. FAIRCHILD STREET • DANVILLE, ILLINOIS

Manufacturers of Hurletron Automatic Controls for Color Register, Center Line and Side Web Guide, Cut-off and Back-up, Moisture.

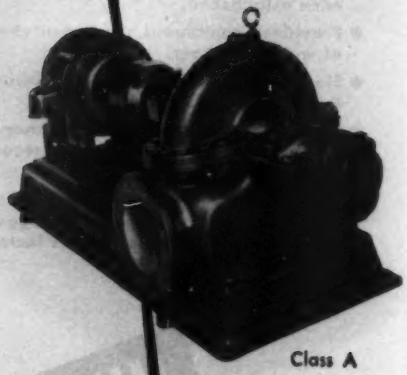
THE LINE OF PUMPS THAT EXPERIENCE BUILT

Class HMSS



Class HMS

Class DVS



Class A

Shartle-Miami pumps reflect in their design a third of a century of study of paper stock pumping problems and every installation receives very special consideration.

The star of the line is the Shartle-Miami Class HMSS. Diagonally and fully split casing enabling the mill mechanics to lift out all operating elements without disturbing the piping connections. Will handle densities up to 10% with ease.

Also shown is the Class HMS—for locations where the inlet has to swing to some position to accommodate the piping.

Still another high-density design is the Class DVS, a vertical pump that also features a split casing. This particular pump is for installation in cramped quarters and in basements subject to flooding.

The ideal pump for handling water, white water or thin stock is the Class A—also furnished in a vertical design—the Class AV.

These and many other Shartle-Miami pumps in full range of capacities.

BLACK-CLAWSON

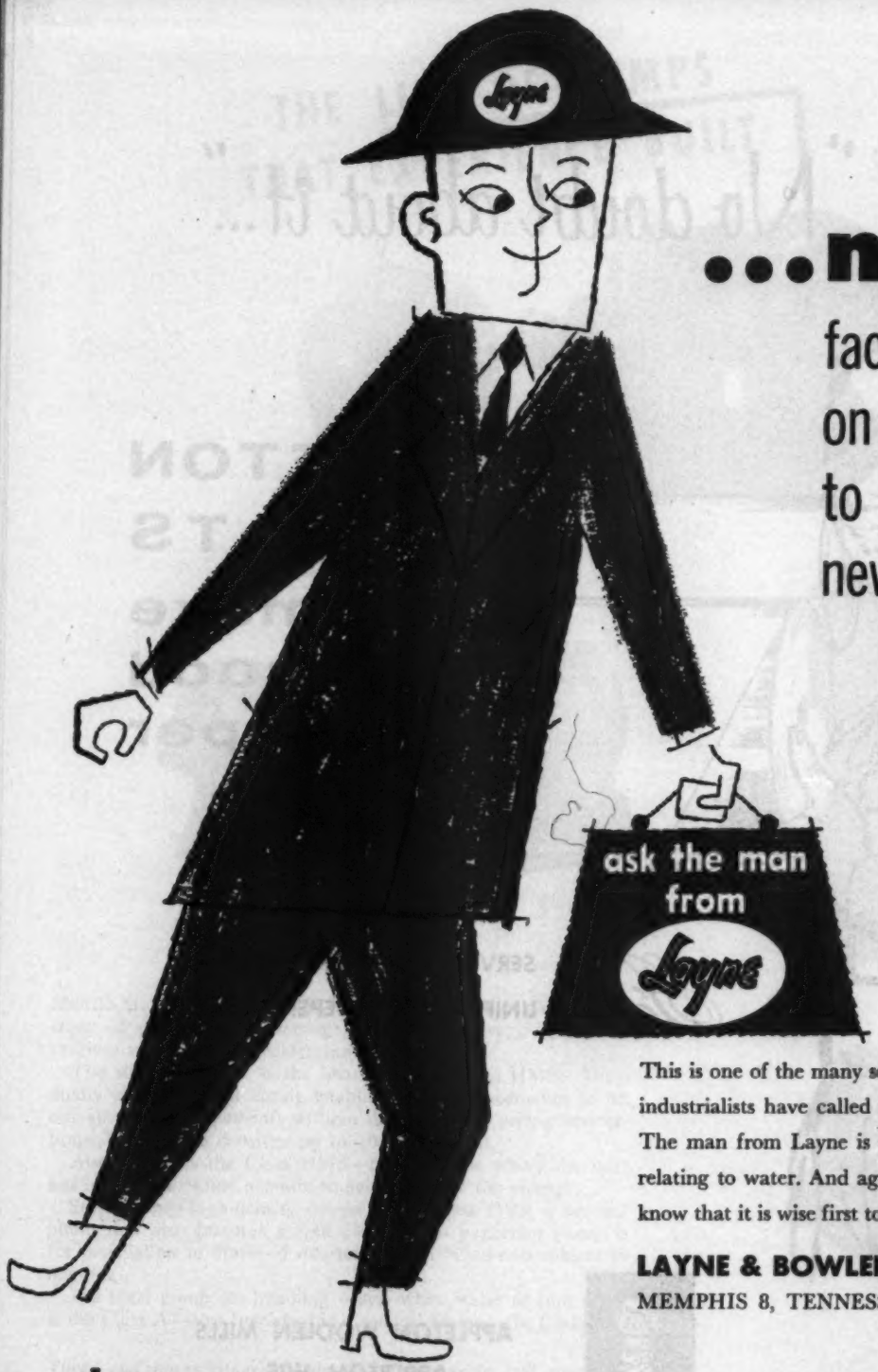
SHARTLE BROS. MACHINE DIVISION • MIDDLETOWN, OHIO

"No doubt about it..."

APPLETON
FELTS
make
good
paper

For ... SERVICE DESIGN FINISH
UNIFORMITY DEPENDABILITY

APPLETON WOOLEN MILLS
APPLETON WIS.



...needed:

factual information on water potential to locate new factory site!

—Many facts must be gathered, screened and verified before a decision that may involve millions of dollars in capital expense is made. And not the least important is the water potential.

This is one of the many services that leading industrialists have called upon Layne to perform. The man from Layne is eager to answer any questions relating to water. And agriculture, industry and municipality know that it is wise first to "ask the man from Layne."

LAYNE & BOWLER, INC.
MEMPHIS 8, TENNESSEE

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water wells • vertical turbine pumps • water treatment

STICKLE NEWS

Stickle Equipment
Cuts the cost of steam

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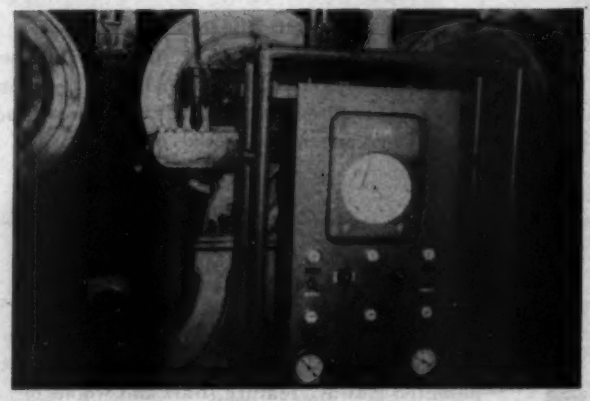
Newton Falls Paper Mill Reports on Stickle Moisture Control System



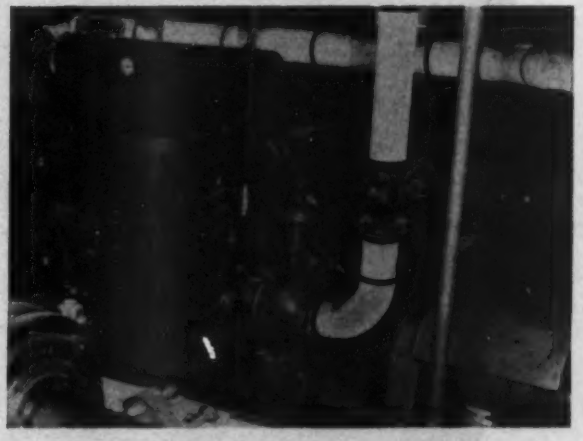
Automatically Maintains Moisture Content Within Plus or Minus 0.5 Percent

For the past year, the Newton Falls Paper Mill has operated the Stickle Pres-Ten-Trol moisture control system under practically every conceivable condition. Here is what Newton Falls men say about the Stickle system: (1) Maintains moisture content within plus or minus 0.5% on the average, (2) Restores proper moisture content after breaks up to eight times as fast as former methods, (3) Eliminates time-consuming hand adjustment of steam flow to the dryers, (4) Reduces complaints of customers on moisture variation, and (5) Reduces steam consumption. Put an end to your moisture control problems. Write for Stickle bulletin 360-C.

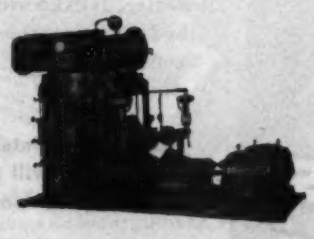
Drainage System Guaranteed to Increase Production, Lower Fuel Costs

Mills Report Dryer Capacity Up 20 to 30%; Fuel Costs Down 10 to 15%

Mill after mill reports higher production and lower fuel costs after installing the Stickle Vacuum Differential Drainage System. Here is an example in one mill, the No. 4 machine was running at 590 to 600 f.p.m. at a drying pressure of 12 to 15 pounds. Attempts at higher speeds resulted in cockled paper and by-passed steam traps. After installation of the Stickle system, speed was increased to 750 to 800 f.p.m., at a drying pressure of 8 to 10 pounds — with no cockling and no traps by-passed. Main unit of the drainage system is the vacuum pump shown at right. Send for free bulletin 260. For paper board mills, the Stickle Differential Drainage and Boiler Return System (Bulletin 160) is recommended.



"X-Ray" view of the Stickle Open Coil Deaerating Feed Water Heater . . . guaranteed to heat more water to higher temperature in less space than any other heater at any price. Capacities: 3,000 to 300,000 pounds per hour.



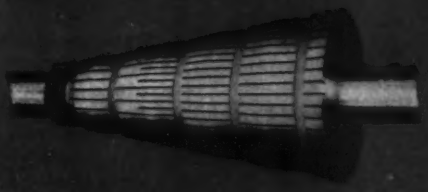
The Stickle Vacuum Pump is main unit of the Vacuum Differential Drainage System. Single and duplex models. Capacities up to 300 GPM (water) and 290 CFM (air); or 900 GPM (water only).

Stickle Visible Micro Adjustable Orifice permits accurate modulated temperature control on dryers with visible operation. Eliminates steam losses due to excessive "blowing through" into return lines.

Stickle Automatic Differential Valve controls exact differentials in pressure between two sections of paper machine, assuring proper drainage at all pressures.

E.D. Jones

has the answer to your Maintenance and Modernization Problem

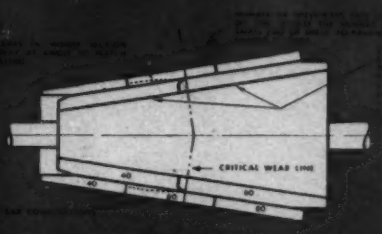


Famous Jones engineering, and over one-hundred years' experience with every type mill and all kinds of paper, are at your service . . . insure satisfaction, whatever your requirements, when you specify JONES maintenance, repair and modernization parts and accessories.

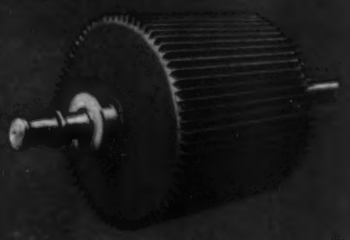
JORDAN PLUGS AND FILLINGS

Type P-B PLUG. Dynamically balanced at operating RPM. Easy refilling — no bands to shrink on. Bands mounted permanently in place. Made in sizes to fit any make or size of Jordan.

Greylock Shell Filling. Pre-assembled in a rugged conical assembly. Harrigan design with patented Nowave feature. Bars and woods of any desired standard materials.



Nowave Patented Plug & Shell Fillings provide precise plug and shell alignment, better and more uniform refining, straighter bar wear — no waves or shoulders, longer filling life.



BEATER ROLLS AND BED PLATES

Built in all types and sizes for any make of beater, JONES Beater rolls, bars, woods and bed plates incorporate advanced design, sturdy construction and the finest of workmanship and materials.

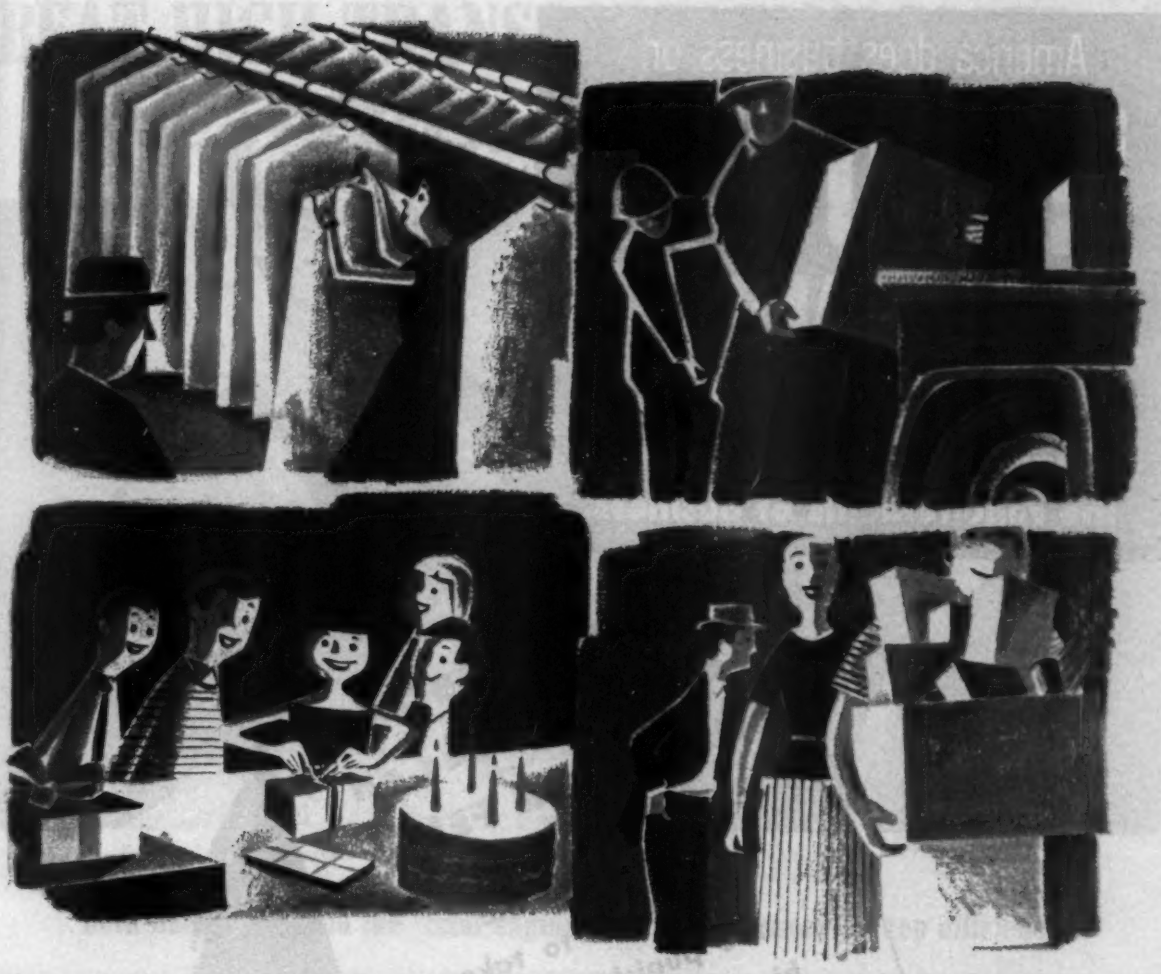
On every maintenance or replacement problem, it will pay you to consult your Jones representative *first*.

E.D. Jones

BUILDERS OF QUALITY STOCK PREPARATION MACHINERY

E. D. Jones & Sons Company, Pittsfield, Mass.

In Canada: The Alexander Fleck Limited, Ottawa



How paper helps market the wares of the world

General Offices, Appleton, Wisconsin

Plants at Appleton, and Montgomery, Alabama.

From producer to consumer, paper for packaging is a vital and rewarding link . . . ambassador of good will and good deeds . . . preventing costly spoilage or damage to everything from foods to machinery, clothing to crockery . . . upgrading quality and appeal . . . building sales of goods and services everywhere.

And in at the very start of packaging paper—in every field where paper goes to work . . . Fourdrinier wires. Appleton Wires. Good wires—by a 59-year test of industry-wide acceptance and use.

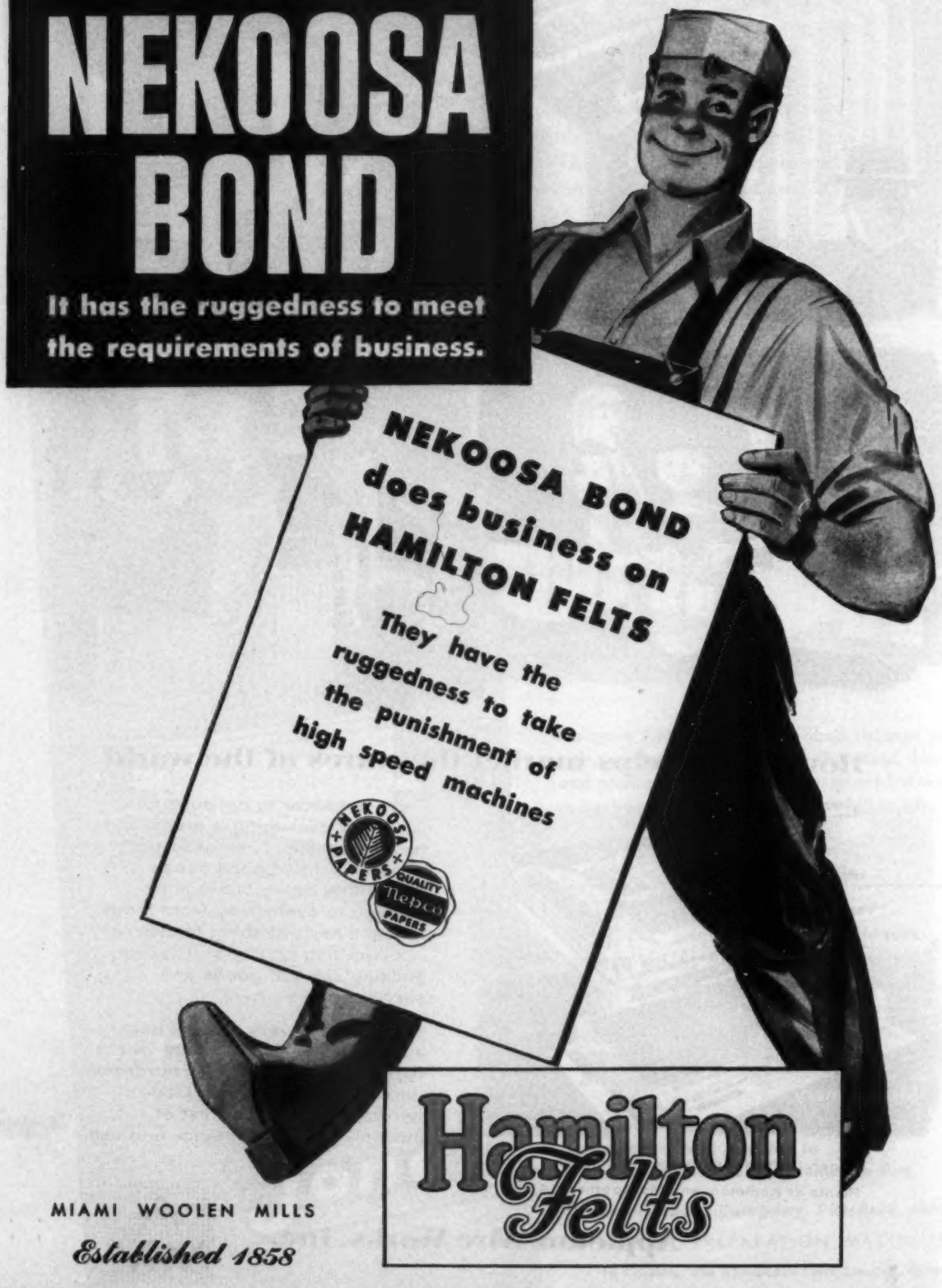
Appleton Wire Works, Inc.

Appleton, Wisconsin

America does business on

NEKOOSA BOND

It has the ruggedness to meet the requirements of business.



MIAMI WOOLEN MILLS

Established 1858

Hamilton Felts

SHULER & BENNINGHOFEN, HAMILTON, OHIO

BEAT HIGH TRANSPORTATION COSTS--

carry the load via belt conveyors

Engineered for overall efficiency, this Link-Belt 30-in. wide belt conveyor uses 45° roller bearing idlers for maximum chip carrying capacity.

LINK-BELT offers you the "total engineering" so necessary for top efficiency

DESIGNED FOR OVERALL EFFICIENCY

Because of its unrivalled experience, Link-Belt can do a better job of gathering and analyzing all data. Proposals reflect this understanding of the most practical way to fit conveyors into your system requirements.

BUILT FOR LONG-LIFE PERFORMANCE

Link-Belt manufactures all components and related feeders and conveyors. You are assured of the right equipment because of this breadth of line. And Link-Belt will supply the highest grade belts engineered to the job.

DELIVERS FULL RATED CAPACITY

Link-Belt follows through on every detail of the job, including electrical controls and even wiring and foundations. What's more, Link-Belt will furnish experienced erection superintendents, staffs and skilled crews.

ASSURES SATISFACTORY PERFORMANCE

When you rely on Link-Belt as a single source for your complete system, Link-Belt accepts responsibility for placing it in full operating readiness. We will also supervise modernization of existing systems.

Next time you're in the market for one belt conveyor or a complete system, call a conveying expert in the Link-Belt office near you. It's his job to help you get the best in belt conveying at the lowest possible overall cost.

LINK-BELT

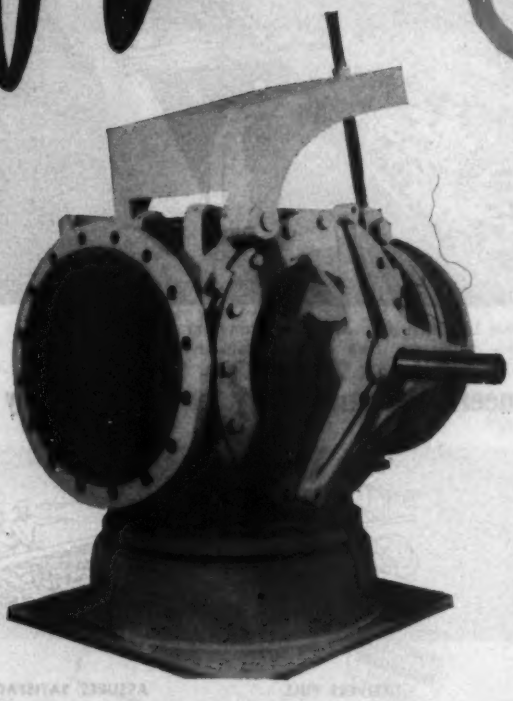
BELT CONVEYOR EQUIPMENT

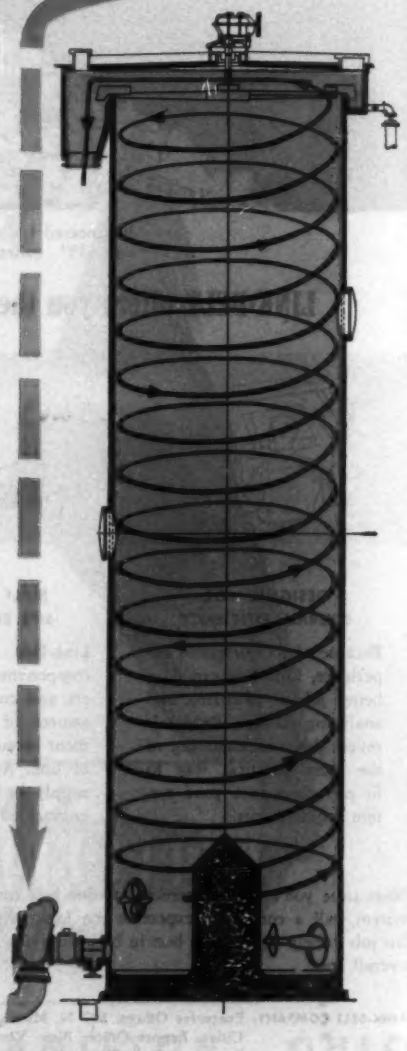
LINK-BELT COMPANY: Executive Offices, 307 N. Michigan Ave., Chicago 1. To Serve Industry There Are Link-Belt Plants and Sales Offices in All Principal Cities. Export Office, New York 7; Canada, Scarboro (Toronto 13); Australia, Marrickville, N.S.W.; South Africa, Springs. Representatives Throughout the World.

18,300-A

Good Bleaching

STARTS HERE





IMPCO CHLORINE SAVER-MIXER

A new high intensity type chlorine mixer which gives a quick intimate mixing result, improving retention in the main tower and insuring uniformly chlorinated pulp.

This unit showed chlorine savings of 50c per ton or at a 300 ton daily production rate, over $40,000 per year, paying for the mixer in just a few months.

IMPROVED MACHINERY INC.

Sherbrooke Machineries Ltd. Sherbrooke, Quebec manufacture similar equipment in Canada. C3-a

Rolling along at a 3500 ft. per minute clip

Appleton Rewinders depend on Ross exchangers to keep hydraulic fluid cool

Producing uniformly wound paper rolls of consistent density, at speeds of 3500 fpm and faster, this Appleton Rewinder utilizes hydraulic power for two of its major operating features:

(1) To raise and lower the riding roll. (2) To eject the finished roll onto the receiving mechanism.

In order that these operations can be carried out properly, hydraulic oil temperatures must be constant — allowing no chance for hydraulic slippage through thinned, overheated oil! *The Appleton Machine Company furnishes a built-in Ross Exchanger for just that purpose.*

Because they have continuously proved their extreme suitability and dependability, Ross Exchangers are daily performing many other temperature-safeguarding functions in the paper and pulp field. Appleton applications alone cover several: on super, machine and embossing calenders; on pulp grinders — either for bearing lubrication or hydraulic pressure systems, or both. Likewise, Ross Exchangers have become standard equipment on paper machine dryers, turbine drives and Diesels of numerous makes.

The Ross advantages of enduring all-copper and copper alloy construction, pre-engineering, complete standardization and mass production have won the preference and confidence of machinery builders serving *every* field — not alone paper and pulp. It will be to your benefit to have a copy of Bulletin 1.1K5 for details. Write.

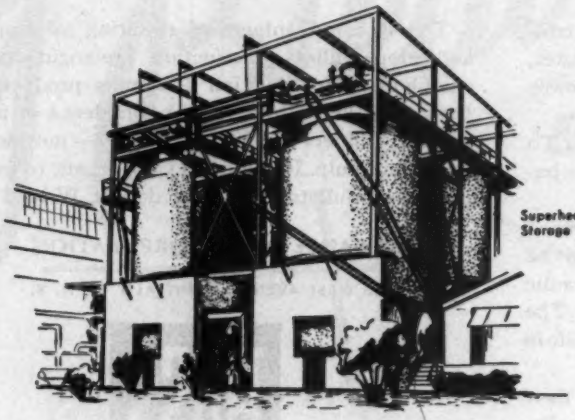
KEWANEE-ROSS CORPORATION

DIVISION OF AMERICAN RADIATOR & STANDARD SANITARY CORPORATION

1430 WEST AVENUE • BUFFALO 13, N. Y.

KEWANEE-ROSS PRODUCTS

Serving home and industry: AMERICAN-STANDARD • AMERICAN BLOWER • CHURCH SEATS & WALL TILE • DETROIT CONTROLS • KEWANEE BOILERS • ROSS EXCHANGERS • SUNBEAM AIR CONDITIONING



Superheated Water Storage Tanks

Crude Sulphur

for Industrial Use

from the properties of

Texas Gulf Sulphur Co.

75 East 45th Street • New York 17, N. Y.

Producing Units

- **NEWGULF, TEXAS**
- **MOSS BLUFF, TEXAS**
- **SPINDLETOP, TEXAS**
- **WORLAND, WYOMING**

Looking in on Perkins Calender Roll Shop, Largest in the World

In this modern, completely equipped press roll shop, Perkins famous Calender Rolls of all sizes and combinations and fillings are in process . . . under heavy pressure for a predetermined period of time . . . to produce Perkins Calender Rolls to meet exactly the requirements of the paper and textile industries.

B. F. PERKINS & SON, Inc.

ENGINEERS AND MANUFACTURERS

HOLYOKE, MASS.

***Southern Sales Office:* 1609 Liberty Life Building, Charlotte, North Carolina**

POWELL VALVES . . . THE COMPLETE QUALITY LINE . . . POWELL VALVES

. . . THE COMPLETE QUALITY LINE . . . POWELL VALVES . . . THE COMPLETE QUALITY LINE . . .

POWELL LUBRICATED PLUG VALVES

FIG. 3059G—300-Pound Steel Flanged End Valve. Sizes 6″ to 12″.

FIG. 1559—150-Pound Steel Flanged End Valve. Sizes 1″ to 4″.

. . . THE COMPLETE QUALITY LINE . . . POWELL VALVES . . . THE COMPLETE QUALITY LINE . . .

POWELL VALVES . . . THE COMPLETE QUALITY LINE . . . POWELL VALVES

Powell Valves—the *complete* quality line—offer many outstanding features in these new Lubricated Plug Valves, such as quick and sure operation and a positive seal when the valve is closed.

Valves are available with screwed or flanged ends; single, screwed and bolted gland types, and in Semi-Steel, Carbon Steel, Bronze, Ni-Resist, Monel Metal, and Stainless Steel. Semi-Steel valves are rated 175 and 200 pounds W.O.G.; Steel valves, 150 and 300 pounds W.P. Sizes from 1″ to 12″. Valves in sizes 6″ and larger can be furnished with gears for gear operation. Distributors located in principal cities. For descriptive literature—or help on valve problems—write direct to

The Wm. Powell Company, Cincinnati 22, Ohio.....109TH year

CURRENT COMMENTS

Tariffs and the new Congress . . . South America . . . and 1955 optimism

"Where do we go from here?" is a question that has come to the fore during the past few weeks, as politicians are beginning to appraise the long-term effect of the Democratic victory in the November elections. Will there be new tax legislation? Will the government find ways to relieve the admitted problems that will arise for the American economy when the projected foreign trade program gets well under way?

The latter question is worrying the Congressional majority. Senator Kennedy, Massachusetts Democrat now convalescing, introduced a bill during the last Congress to subsidize some industries, workers and communities that have suffered from the freer entry of foreign products into the American market. Labor's member on the Randall Commission presented a detailed recommendation for a nation-wide program of such relief. And Chairman Randall has already declared that while the labor proposal was not made part of the commission's recommendations, it was listed in detail as a problem for further study.

Broadly, the proposals involve nation-wide subsidies to industries and communities suffering from idle factories whose product has been supplanted by foreign merchandise imported under the advantage of reduced duty rates. Under these suggestions, labor would be retrained for other jobs.

Machine tender's problem

In the paper industry, where could a machine tender now earning $2 or more per hour find a job paying the equivalent, taking into consideration his years of experience, his training and his seniority?

The solution is "nice in appearance," but its practicality in the paper field is exceedingly problematical. The paper industry has suffered more than any other American industry from repeated reductions in duty rates, until its rates are far below the average. Hence, this problem is vital to this industry, inasmuch as the administration and the Democratic majority are apparently determined to unite for the further curtailment of the limited protection now accorded American industry.

The real problem for industry generally, however, is this: If duty rates on all commodities are further reduced, as presently planned, what industry will remain which can absorb the labor force displaced by other industries?

An interesting sidelight on the tariff picture is that the industries which are most vehement in calling for further duty rate concessions are themselves investing heavily abroad in production of machines for export to this country. One important popular automobile is openly advertised as made abroad. A well-known typewriter is assembled in Great Britain, where labor is cheaper, from parts made in this country. How much longer the parts will continue to be made here remains to be seen.

Opposition to tax revision

The Democratic drive to revamp the mammoth tax revision program passed by the last Congress is likely to meet with strong opposition. The Democrats want to make a big income tax reduction for everybody in time to have its effect on the 1956 elections. Former Chairman Reed of the Ways and Means Committee of the House of Representatives, which formulated the 1954 tax revision legislation, says that the labors of the past Congress cannot be thrown into the discard for a frankly political objective. He says the effort to enact a scientific tax law was so sincere that even many Democrats will not go along with a new political program. Mr. Reed says that the historic Democratic policy is more taxes, new taxes and higher taxes, and that the public wants none of this. However, Congressman Rayburn, the probable next Speaker of the House, says tax revision is a must.

South of the border

Herbert Hoover Jr. has returned from a Latin American economic conference highly enthusiastic over the manner in which the Americas are lining up as a unit for economic development. However, the conference held at Buenos Aires is now seen to have resulted in a major step in the program for development in South America of a paper and pulp industry. The conference was originally scheduled to give the representatives of the United Nations Food and Agriculture Organization and the Foreign Operations Administration an opportunity to formulate programs for increased paper and pulp production through the Export-Import Bank and the International Bank. These representatives, profanely known in some conservative quarters as the "give-away boys," were surprised at the proposal from the United States paper industry that it would cooperate in any economic program for practical development of such an industry in Latin American nations.

The United States paper delegation frankly offered to transmit to the industry in the United States any opportunities which were economically sound for United States industry individual consideration. Such opportunities were said to be worth investigating, and that the United Nations type of financing should be invoked only when local and foreign companies had been given an opportunity to judge of the soundness of any expansion proposals.

There was much discussion of the possibility of increased utilization of bagasse, and there was evidently no uniform agreement that such usage alone solve the problem.

The development of a paper and

Current comments . . .

pulp industry in the southern continent involves the problems of home supply of necessary paper, a possible curtailment of existing United States export markets, and the possibility of using such expansion to provide dollar profits by sales of low-cost papers into the high-wage United States market.

Laurels for neophytes

As the year 1954 draws to its close, it appears that the optimistic neophytes in the paper field were possibly better guessers of the extent of paper and paperboard production than the men supposed to have the better knowledge of market conditions. At the time of the 1954 annual conventions in February, it was said that the industry would consider itself fortunate if the 1954 production were not more than 7 per cent under the total tonnage of 1953.

It now appears that 1954 production will be not more than 1 per cent under that of 1953, the previous high record year. In achieving this total, the manufacture of paper almost entirely overbalanced the reduced output of paperboards. Paperboard production was nearly 6 per cent under 1953, in comparing the first half of the two years, but tonnage has made up some of this slackness in recent months. October production of paper was the third highest of any month in the industry's history. Paperboard was much improved over the early months of the year, and while it was 35,000 tons less than in October 1953, the tonnage was 100,000 tons heavier than in September.

Over-all, 1954 has been a good year for the entire industry. Trends continue high, with no apparent pessimism over the prospects for 1955.

Financial Reports

With the securities markets going to new record high levels, paper mill issues are in general following the leadership of the blue chip stocks. However, there seems to be at least a temporary leveling off in such securities.

Net Incomes

American Writing Paper Corp.—Net income for the first nine months was $885,108, as compared to $418,392 a year ago.

Certain-Teed Products Corp.—Net income for the nine months ended September 30 was $3,420,720, as compared with $2,983,931 last year.

Chesapeake Corp. of Virginia—Net income for the 40 weeks ended October 3 was $2,130,803, as against $1,728,242 a year ago.

Container Corp. of America.—Net income for the nine months ended September 30 was $11,022,000, as against $7,589,000 last year.

Crystal Tissue Co.—Net income for the first nine months was $163,448, as compared to $159,957 last year.

Dixie Cup Co.—Net nine-month income was $3,004,992, as compared with $2,272,697, in 1953.

Federal Paper Board Co. Inc.—Net income for 36 weeks to September 11 was $2,180,000, as against $1,410,000 a year ago.

Robert Gair Co. Inc.—Net income for the first nine months was $3,769,951, compared with $4,621,669 for the same period a year ago.

P. H. Glatfelter Co.—Net income for the first nine months was $249,062, as against $181,819 a year ago.

Paper mill corporate changes

Federal Paper Board Co. Inc. has offered 200,000 shares of common that will be listed on the New York Stock Exchange. The offering is not a new issue, but securities held by present stockholers.

Gaylord Container Corp. and *St. Regis Paper Co.* have dropped negotiations for a contemplated merger.

Racquette River Paper Co. is negotiating a merger with *Orchard Paper Co.* of St. Louis, presently a large consumer of Racquette River papers. The proposed merger would result in an expansion of Racquette River's production facilities and coordinate its basic production with retail distribution of converted products.

Stock and Bond Quotations

New York Stock Exchange — Stocks

Closing Prices	Dec. 10, 1954	Nov. 10, 1954
A.P.W.	5	3¾
Celotex	27⅞	26
Same Preferred	18½	*18¼-18½
Certain-Teed	24½	23⅝
Champion P & F	54½	53¼
Same Preferred	104½	*105½-106
Chesapeake Corp.	42	38⅝-39⅝
Container Corp.	63¾	62⅝
Same Preferred	104¼	104
Continental Diamond	13⅝	12½
Crown Zellerbach	59⅛	59½
Same Preferred	104½	*104-104¾
Dixie Cup	59¾	58¼
Eastern Corp.	23¼	21½
Robert Gair	28⅜	26⅛
Gaylord Container	23½	35
Great Northern	69	70
Hammermill	23¼	23¼
International	83¼	86½
Same Preferred	105	*105½-106½
Kimberly-Clark	40¾	39½
Same Preferred	157	*156-160
MacAndrews & Forbes	49	46
Marathon	28¾	28
Masonite	25⅝	24¼
Mead Corp.	53⅜	46⅝
Same Preferred	101½	*98¼-99
Same Second Pref.	60¼	....
National Container	14⅝	12¾
Same Preferred	25½	25¼
Rayonier Inc.	57¼	54½
Same Preferred	38	38¼
Scott Paper	60½	52
Same $3.40 Pref.	96	*95-95¼
Same $4.00 Pref.	107½	*107-108½
St. Regis Paper	36⅞	34⅛
Same Preferred	103¼	102⅝
Sutherland Paper	46⅝	48½
Same Preferred	....	....
Union Bag & Paper	67½	66⅝
United B. & C.	18	*19½-18⅝
United Wall Paper	1⅞	1¾
Same Preferred	16	*16½-17
U. S. Gypsum	222	215
Same Preferred	182⅝	*182-184
West Virginia	37½	35
Same Preferred	108⅝	*108-111

New York Stock Exchange — Bonds

Celotex 3¼%	....	....
Champion P & F Co.	....	....
Mead Corp. 2%	....	....

American Stock Exchange — Stocks

American Writing	....	17
Brown Company Common	15	16⅞
Same $5 Preferred	108	110
Same $3 Preferred	53¾	55
Puget Sound	....	41

*Closing Bid and Asked Prices.

This unretouched photograph shows a 1% solution of Kelsize twenty minutes after being puddled on blotter. Note how solution remains on surface of blotter. This test illustrates that the filming properties of Kelsize or Kelgin hold water on the surface fibers longer thus providing better lubricating action during calendering. This permits more smoothing action by calender rolls before penetration of aqueous solutions occur.

SMOOTHER SMOOTHNESS WITH KELGIN or KELSIZE

Here is unretouched photograph of water, without Kelsize, on piece of same blotter, taken seconds after water was placed on blotter. Note how water has immediately passed into blotter compared to controlled penetration of Kelsize solution. Proof that Kelsize and Kelgin are superior surface control agents.

Due to their colloidal and film forming properties Kelgin and Kelsize also contribute the following improvements:

1. Control penetration of adhesives, starch solutions and most water base solutions.
2. Improved smoothness and finish.
3. More uniform printing surface.
4. Higher and more uniform Gloss and Flat Ink Printing.

   Increased oil, wax and varnish resistance.

KELGIN® or KELSIZE®

products of

KELCO

company

20 Wacker Drive, Chicago 6, Ill. 31 Nassau Street, New York 5, N. Y. 530 W. Sixth Street, Los Angeles 14, Calif.

Cable Address: Kelcoalgin — New York

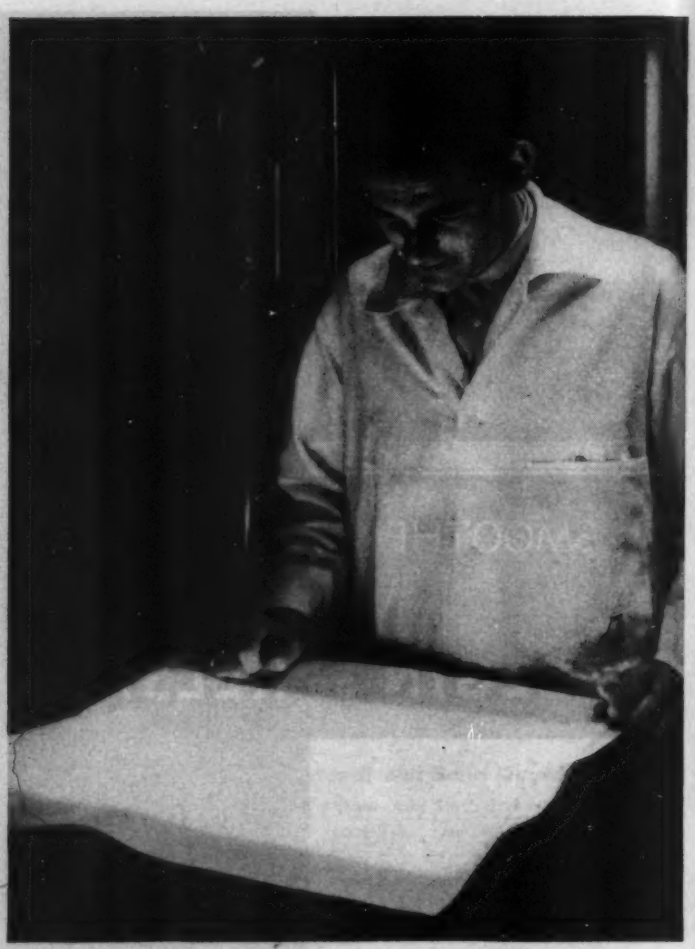
BETTER PAPER

through Hercules Chemicals

Hercules® Defoamer 4 kills foam economically and contributes to improved quality paper and board.

A 2½ pound brick of Defoamer 4 readily disperses in water to make 40 gallons. And the convenience of the brick form means no waste, no mess, and no heavy drums to handle or ship.

Where foam is a problem, we would welcome the opportunity to discuss with you what our defoamers might do to improve the quality of your product. Hercules defoamers are available in liquid and paste forms as well.



EYE APPEAL—This paper is being examined over a light box to check for formation and defects. The right defoamer can be helpful in obtaining good visual appearance of the sheet.

CONVENIENT PACKAGE—Defoamer 4 bricks are available from any of Hercules' strategically located supply points.

FOAM such as this impedes production, lowers the quality of paper and board. It can be economically controlled by the use of Hercules' defoamers.

Paper Makers Chemical Department

HERCULES POWDER COMPANY

INCORPORATED

961 King Street, Wilmington 99, Delaware

PPS4-6

The Paper Industry

January 1955

Is the expansion pendulum swinging north?

NO ONE CAN HELP being impressed with the spectacular growth during the last decade of the pulp and paper industry in the southern states. Today there are signs that this expansion will be matched or — given sufficient momentum — even surpassed in the northern states.

Among the signs that presage a northward swing of the expansion pendulum are, foremost, the wide interest in and application of technological advances that permit the utilization of hardwoods — such as poplar, beech, birch, maple, hickory and ash — in high-grade paper manufacture. These technological advances include improved pulping, bleaching, and refining methods that produce a hardwood fiber of suitable strength and properties — and of high yield.

Then, there is evidence of intense activity in some northern mills to find new and specialized uses for northern sulfate paper and board.

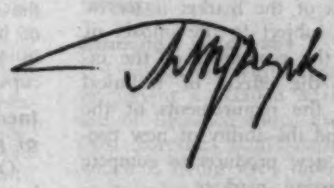
The momentous and far-reaching expansion now underway at Great Northern's East Millinocket mill — which has already resulted in the start-up of a new 250-ton newsprint machine and will by the end of 1955 add a similar machine to the company's productive capacity — matches any single mill expansion that has taken place in the South.

Further impact to the anticipated trend is lent by the recent statement of James M. Madden, vice president of Scott Paper's Hollingsworth & Whitney Division, to the effect that the construction of a new mill, originally planned for Alabama, will now take place in Maine.

Other major expansions — either completed, underway, or planned — include the new 2000-fpm paper machine put into operation by Fraser Paper Ltd. in Madawaska, Maine; Brown Co.'s new sulfate bleachery and furfural plant at Berlin, N. H.; two semichemical pulp mills are under construction in Ohio, i.e., those of Container Corp. of America and Stone Container Corp.; and Hammermill's $5,000,000 expansion in Pennsylvania to include new bleaching and pulping facilities for hardwoods.

Also in line with the expansion trend — and one might say in anticipation of the industrial revival in the North — have been the various pulpwood and conservation programs launched over the past years by various pulp and paper manufacturing enterprises. These programs have the objective of utilizing and making pulpwood sources highly productive within reasonable proximity of the mill, and managing these woodlands in such a way as to ensure a never-depleting supply of pulpwood.

All this activity adds up. While each development may not be too remarkable in itself, jointly they have the earmarks of initiating a veritable avalanche of industrial growth and consolidation in the North.



Product upgrading through bleaching

The eight papers constituting the article section of this issue of THE PAPER INDUSTRY — showing the latest developments and the latest thinking in pulp bleaching, trends in the extension of the use of bleached products to new fields, and the market outlook for bleached pulps — were presented at the Third Annual Pulp and Paper Conference sponsored by the Department of Chemical Engineering and the Industrial College of Engineering, University of Florida, Gainesville, Fla., December 6-7, 1954.

Harry E. Weston, secretary and treasurer of the American Pulp & Paper Mill Superintendents Association, was chairman of the Conference.

The high quality of the papers and the extreme timeliness of the discussion on bleaching — in view of the envisaged stepped-up extension of bleaching, among others, to paperboard for packaging, and to food and liner board — prompted the decision to publish these papers *en bloc* in a single issue.

In an exemplary appraisal of the market outlook for bleached pulps, John H. Vogel discusses the marked recent trend toward the use of paper for utilitarian as opposed to cultural purposes. Furthermore, many paper products are no longer merely functional — they have become "silent salesmen" which by their own appeal must attract and influence the customer.

W. J. Nolan and Bruce Armstrong propose an ingenious five-stage high-density bleaching operation with conventional bleaching agents that conceivably might reduce bleaching time to 30-45 minutes instead of the currently practised 7-hour process.

R. L. McEwen and T. C. MacGugan describe three peroxide bleaching processes developed by Becco and discuss their application to the various types of pulp.

W. Howard Rapson describes the high-density up-flow type towers for chlorine dioxide bleaching which are now being built in various countries, and discloses some of the results on optimum bleaching conditions obtained at the University of Toronto.

Bleaching of southern pine pulp to 88-90 brightness with chlorine, caustic, and hypochlorite, and without undue strength loss, is reported by George Seymore — showing that there still are many opportunities in using the cheapest known bleaching agents.

Results, problems and methods pertaining to the bleaching of kraft, neutral sulfate semichemical, and groundwood pulps are discussed by A. L. Wiley, Gerald Haywood and Anthony A. Yankowski respectively.

No one interested in maintaining his position in this dynamic and competitive industry can afford not to familiarize himself with this informative series of articles on bleaching. The editor regrets that limitation of space made certain non-vital deletions necessary.

The market outlook for bleached pulps

JOHN H. VOGEL
Economist
American Paper & Pulp Association

WHILE WE are inclined to speak of the paper industry as a homogeneous unit, it is well to keep constantly in mind the fact that in reality it is composed of many segments which are sometimes closely and sometimes distantly related. It is a short step from bond to offset paper and a long, long step from container board to condenser tissue. Each of these segments of the industry is unique in some respect, as its competitive position and opportunities for growth are influenced by forces peculiar to the requirements of the market it serves. Yet all are subject to the impact of changes in the economics of the industry and the effects of technical changes on the requirements of the consumer and the ability of new producers and new products to compete for the existing markets.

There are numerous illustrations of shifts in production — the movement from newsprint to groundwood printing and converting grades by United States mills, as Canadian producers, aided by removal of the tariff, became the major supplier to the newspaper publishers of this country. The other side of this particular coin turned up in the late 1930s when, following years of research on flax fiber, a United States mill was successful in producing cigarette paper. Since then our dependence on imports of such paper from France has become a thing of the past, and now a substantial export market has been developed. More recently we have seen the rapid increase in the manufacture of corrugating board from semichemical pulp; the growth of multi-wall shipping sack output, and the mercurial rise in the manufacture of bleached board and paper for use in producing milk bottles, drinking cups, frozen food cartons, etc.

Increasing utilitarian use of paper and board

One of the major changes that has been taking place in this industry—and undoubtedly will continue to be a principal growth factor in the future—has been the steady increase in the use of paper and paperboard for what may be termed utilitarian as opposed to cultural purposes.

As recently as 1939, when United States total production had reached a new high of 13,510,000 tons and per capita consumption was equal to 244 pounds, the combined output of newsprint, book, groundwood and fine papers (the cultural group) was 3.7 million tons, about 27 per cent of the total, and of the utility grades 9.8 million tons, equal to 73 per cent of the total. In 1953, a mere 14 years later, when production approached 26.5 million tons and per capita consumption was 391 pounds, the production of cultural papers was 5.9 million tons, 22 per cent of the total, and of utility grades 20.5 million tons, equal to 78 per cent of the total. Now what is the significance of this? It is not only that there has been a change of 6 per cent in the relative importance of each group. It is that, while the former group was experiencing a growth of slightly more than 2 million tons, the latter was increasing by almost 11 million

tons, a ratio of 5 to 1. It is expected that the future growth of this industry also will be concentrated to a degree in the utility grades as the usage of paper continues to spread through our economy. This is important because it constitutes evidence that the eggs of the industry are in, and will be in, increasingly more baskets than ever before, lending even greater strength and stability to the industry.

Paper is not only a relatively low-cost product, but, because it is highly susceptible to combination with other materials by lamination, coating and impregnation, its possible applications are limited only by the imagination and genius of man. As a result, the paper industry, giving new meaning to the saying, "If you can't beat them join them," has enjoyed a high degree of success in meeting the competition of films, foils and plastics. While transparent cellulose and non-cellulose sheeting has undoubtedly reduced somewhat the market for paper bags, the use, for example, of polyethylene as a coating to provide a moisture barrier has unquestionably enabled bags to penetrate markets, such as the chemical, which previously were beyond their reach. I do not mean to imply there are no substitutes for paper. There are and they are growing more numerous. They represent competition from without the paper industry and, over a period of time, will quite likely affect the composition and distribution of its product lines.

Competition for a share of the shopping dollar

I believe we can all agree that in numerous fields the products have a high degree of similarity in appearance and in what they will do for the individual. As an illustration, consider the difficulty, not to mention the sense of frustration, one would experience if he were confronted with a bowl containing several brands of corn flakes and given the task of separating them according to manufacturer. Manufacturers recognize the existence of this situation and for that reason are constantly striving to find a means whereby they will be able to create a separate and distinct demand for their own line of products. Why? Simply because by creating in the mind of the buyer the belief that his product is possessed of some distinct quality, by creating a demand for his particular product, he is not only able to sell a larger quantity, but the demand for his line becomes more stable; and, if he is particularly successful in his efforts, he may be able to obtain a slightly higher price for his product. This competition is not merely between identical or similar products but between all products. It is not only competition between the canners or the freezers of corn but also between them and the would-be sellers of other types of products. It is, in brief, a competition for a larger part of the purchaser's dollar.

Containers function as silent salesmen

This unceasing competition among sellers for position has been and will continue to be a major factor in the increasing production of bleached pulp, and the paper made from it, for use in packaging of one kind or another. The steady trend toward self-service or self-selection, call it what you will, that developed so rapidly in the super markets and has now moved into the drug, department and hardware stores, has greatly stimulated package engineering and design. No longer is a box only functional as a means of protecting its contents while in transit or in storage. No longer is it only something to throw away at the earliest opportunity. It is a silent salesman which by its own appeal must attract the customer to its contents and subtly influence his selection. I know of no particular reason why a milk carton must be white. Unbleached pulp would serve as well. It is white, of course, because such stock provides the best background for color printing and eye-catching art work; it is white because we have all come to associate white with cleanliness, purity and sanitation. In the recent past we have seen the rapid growth of special food boards, all of which are made from bleached chemical and mechanical pulp, and there can be little doubt that with the passage of time a significant part of the expansion in the use of bleached pulps will be in this field. I do not say it will be as dramatic or as rapid as in the past, but I do believe it will be quite constant. The super market is gaining an ever larger share of the shopping dollar, and as this shift in the point of purchase continues the bleached board requirements for packaging will also grow. The box you and I can see on the shelf, however, is not the only box involved in distribution. The protection aspect has long been emphasized in shipping containers; strength and ability to deliver the goods in one piece have been major selling points. Now that is not enough. As a box containing a given product moves from the manufacturer through the channels of distribution to the retail store it is seen and handled by numerous people. "A recent survey, for example, revealed that at least 232 people saw a packaged product—in this case a television set packed in a printed corrugated shipping case—between the time it left the factory and its time of delivery to the ultimate buyer. By utilizing the free space already available on his shipping containers, the manufacturer can thus greatly increase visual contacts with the public, stimulating potential buyer interest and paving the way for future sales. While mere product-name identification on the sides of the shipping containers is a step in the right direction, it lacks the self-inducing effectiveness of an actual pictorial representation of the product." (*Modern Packaging*, June 1953.)

Half tones on corrugated shipping containers

In the past, the use of half tones on corrugated shipping containers has been difficult because of the relative coarseness of the surface and the high printing plate pressure required. Now, however, a printing technique has been developed which will permit accurate and attractive reproduction work. This will permit the use of corrugated containers for retail store displays. Each of these contacts provides an opportunity for the manufacture to impress the name and perhaps the virtues of his product. As a result, the market for bleached liner board, which I understand is now being produced with a brightness ranging from 85 to 90, will in all probability grow at a very satisfactory rate. Production of this type of board is relatively new and perhaps there is, in a sense, some validity in the arguments that bleaching for this purpose is a form of economic waste. But whether there is or not, the competition between manufacturers for markets will undoubtedly cause its widespread acceptance. For example, it is my understanding that this year Florida citrus fruit packers will ship between 10 and 20 million fiber containers of citrus fruit. And an increasing percentage of this will have a bleached surface as a background for a printed message.

Bleached pulp uses

I would like at this time to be able to present a detailed analysis of the use of bleached pulp, excluding for this purpose semi-bleached sulfate which is being used more and more as a replacement for unbleached sulfite in the manufacture of paper and

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FIG. 2. MAY APPLICATION OF CHLORINE IN

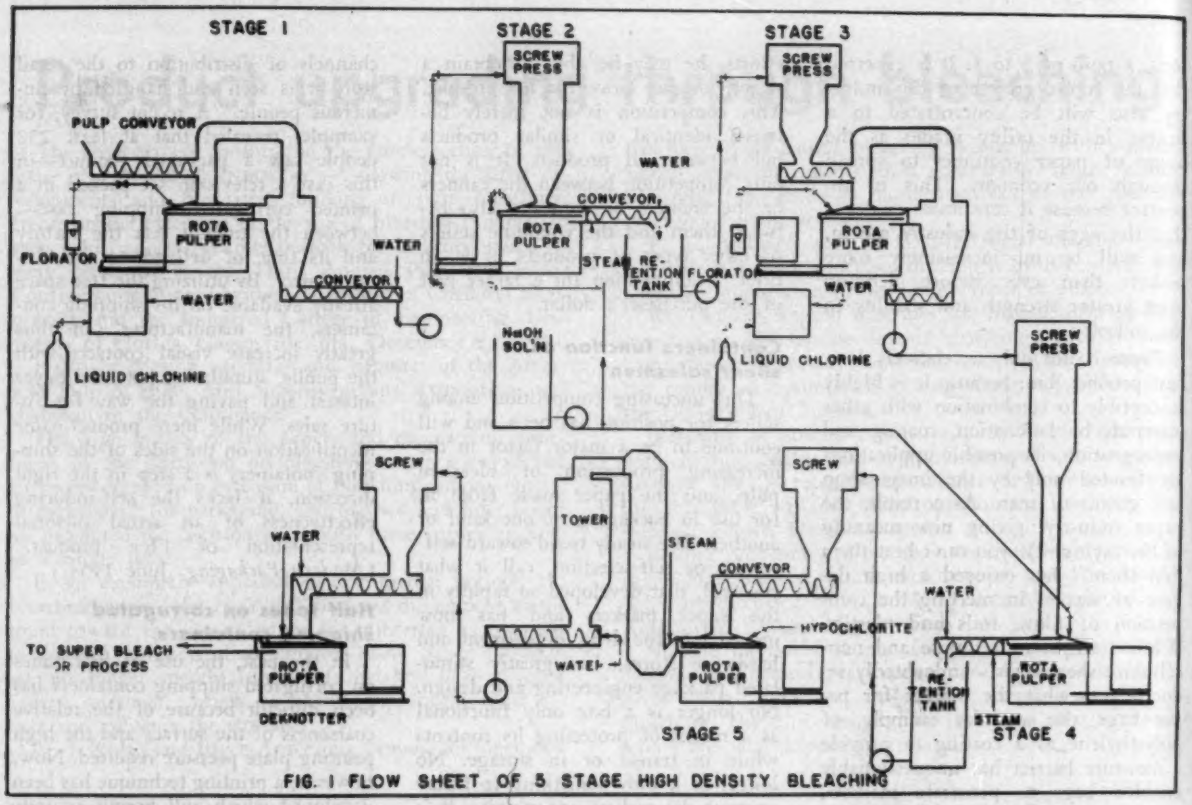


FIG. 1 FLOW SHEET OF 5 STAGE HIGH DENSITY BLEACHING

Multi-stage bleaching at very high density

W. J. NOLAN* and BRUCE ARMSTRONG**

PILOT PLANT EXPERIMENTS, carried out as the Pulp and Paper Laboratory of the University of Florida during the past two years, and several commercial installations have proved the advantages to be derived from the use of very high densities in peroxide bleaching of pulps. The results obtained with peroxide are so encouraging that one naturally projects the techniques of ultra high density into the field of multi-stage bleaching, involving chlorination, alkali extraction, and hypochlorite.

It has been known for several years that, if chlorination of pulp can be carried out at very high density and consequently high concentration, the time of chlorination is reduced to the range of one to two minutes. Campbell and Rolleston† found this to be true in both gas chlorination and sodium hypochlorite application. They were granted a patent on the process, but mechanical difficulties apparently prevented the commercial development of the method. Now that the 015

Rotapulper has proved itself as an efficient means for obtaining uniform blending of bleach and pulp at consistencies as high as 30-33 per cent O.D., it should become economically possible to utilize the advantages of high density processing on a commercial scale.

If the time required for chlorination and hypochlorite treatment can be reduced to the order of one minute, it is obvious that the total processing time in multi-stage bleaching can be drastically reduced. Further savings in processing time can be made in the alkali extraction stages. If caustic is added to the chlorinated pulp at high density and allowed to react for 5-10 minutes before diluting to medium density, the total time of alkali extraction should be reduced from the present two-hour period to a matter of minutes. It is therefore not inconceivable to predict that five-stage bleaching may be accomplished in about 30-45 minutes at high density, in contrast to present low and medium density bleaching, involving seven hours of processing.

An indication of the advantage to be derived from a reduction of the contact time between pulp and bleaching agents can be obtained from the results of some unpublished work carried out in this laboratory. In these experiments the chlorination of the pulp was done in two stages, separated by an alkali extraction. In the first chlorination, time of treatment was 4.0 minutes, while 16 minutes were allowed for the second chlorination. Both treatments were carried out at 3.0 per cent consistency. Chlorine consumption in the first stage was 98 per cent, while the second chlorination consumed only 50 per cent of the chlorine applied. However, chlorine demand in this second chlorination was only 0.37 per cent of the dry pulp. The second chlorination was followed by a standard alkali extrac-

*Pulp and Paper Laboratory, University of Florida, Gainesville.
**Technical Director, Jackson & Church Co., Saginaw, Mich.
†*Paper Trade Journal*, 105, No. 18: 126.

tion and a four-hour treatment with hypochlorite at 12 per cent consistency.

A control sample of the same pulp was bleached, using standard procedures. A single chlorination for 45 minutes at 3 per cent was followed by one-hour alkali extraction, two-hour treatment with hypochlorite, a second alkali extraction for one hour, with a final hypochlorite treatment of four hours. The last four stages were at a consistency of 12 per cent.

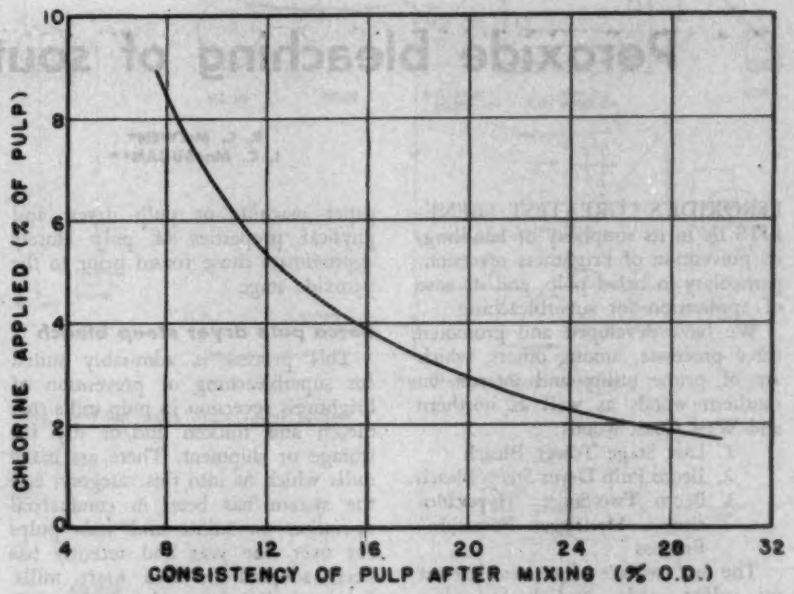
The bleached pulp which had received two short chlorinations instead of one longer chlorination and two hypochlorite treatments attained the same brightness as the control sample. However, the bleached pulp had a degree of polymerization about 200 points higher than the control sample, indicating the decreased degradation which can be attained with decreased bleaching time. It should be possible to reduce pulp degradation to a much greater degree through the use of high density techniques throughout the bleaching process.

A suggested process

Fig. 1 is a schematic representation of such a five-stage bleaching operation. The complete process consists of chlorination in the first stage, caustic extraction in the second stage, another chlorination in stage three, a second caustic extraction in the fourth stage, with a final hypochlorite treatment. In some cases, the fifth stage may be either replaced or followed by a peroxide treatment. After all bleaching is completed, the pulp is passed through a Rotapulper at 10-12 per cent consistency to remove knots formed by the high density processing.

In the first chlorination, pulp at a predetermined consistency is fed in through a gas-tight, rubber-lined conveyor. The pulp will be mixed in the Rotapulper with either chlorine water under pressure or liquid chlorine, depending on consistency and chlorine demand of the pulp. The pulp mixture discharges from the Rotapulper into a cyclone, preferably made of clear plastic. The pulp drops through the cyclone into a rubber-lined conveyor, the length of which is adjusted to give proper retention time (probably in the range of one minute) between chlorine and pulp. A vent pipe part way down the conveyor length not shown in the drawing, can be used to draw off excess chlorine gas, thus permitting better exhaustion of chlorine in the conveyor. Chlorine gas will, of course, vaporize in the cyclone. This gas is recirculated back to the refiner through the gas return from the top of the cyclone. Thus, the atmosphere in the Rotapulper-cyclone system will be made up of 100 per cent chlorine gas, probably at a pressure of 700 mm Hg.

FIG. 2 MAX. APPLICATION OF CHLORINE IN LIQUID PHASE (V.P. OF Cl = 750mm Hg)



The amount of chlorine which can be added in the first stage is a function of consistency of pulp, solubility of chlorine in water, rate of diffusion of chlorine from the gas to the liquid phase and speed of reaction between pulp and chlorine in the water with which the pulp is wet. Let us first assume that all of the reacting chlorine must be supplied as chlorine water at the moment of mixing and no further chlorine will diffuse from the gas to the liquid phase as chlorine is being taken from the liquid phase by the pulp. Under these conditions, it is quite simple to calculate maximum dosage of chlorine.

Solubility data for chlorine in water at 20°C were obtained from *Chemical Engineer's Handbook*. At a chlorine vapor pressure of 750 mm Hg., chlorine is soluble in water to the extent of 7.29 gm. per liter. Using this figure, the chlorine application for various consistencies was calculated. From these data, a plot of per cent chlorine applications, based on dry pulp, vs. pulp consistency was made. This plot is shown in Fig. 2. It can be seen that, at 8.0 per cent consistency, 8.3 per cent chlorine can be applied to the pulp; at 15 per cent consistency, only 4.13 per cent chlorine can be made available to the pulp.

The actual chlorine consumption in stage 1 will be somewhat higher than the values indicated in Fig. 2. Initial absorption into the pulp will be almost instantaneous, causing a drop in chlorine concentration in the liquid phase. Diffusion of chlorine from the gas to the liquid phase will begin immediately, caused by the difference between the vapor pressure in the gas phase and the partial pressure of chlorine in the liquid phase. It is this rate of diffusion which will control the maximum possible chlorination in the first stage. This diffusion of chlorine can only be evaluated by experimentation.

If this rate of chlorine diffusion is sufficiently high, another factor may take over control of the chlorination rate. Some pulps which are high in lignin may build up a film of chlorinated lignin which will block the easy access of chlorine to the remaining unreacted lignin. This is the point at which the first chlorination should be terminated.

The optimum operating consistency, chlorine dosage and residual chlorine must be determined by experimentation with various pulps in the Rotapulper. The rate of diffusion from gas to liquid thus evaluated will determine whether chlorine is added to the Rotapuler in the form of liquid chlorine or as saturated chlorine water under pressure.

As the pulp leaves the first chlorination conveyor (Fig. 1), it is diluted to 4-6 per cent consistency and pumped to a screw press. Nearly all of the hydrochloric acid formed during chlorination will be removed as the pulp is pressed to 40 per cent consistency.

The pulp is then subjected to the action of caustic soda solution in a second Rotapulper. A short retention time of high consistency and high caustic concentration is provided in the screw conveyor following the

(Continued on page 1029)

Peroxide bleaching of southern pulps

R. L. McEWEN*
I. C. MacGUGAN**

PEROXIDE'S GREATEST BENEFITS lie in its simplicity of handling, its prevention of brightness reversion, particulary in baled pulp, and its ease of application for superbleaching.

We have developed and promoted three processes, among others, which are of prime utility and interest on southern woods as well as northern and West Coast woods:

1. Last Stage Tower Bleach
2. Becco Pulp Dryer Steep Bleach
3. Becco Two-Stage "Hypochlorite — Hydrogen Peroxide" Process

The first two are of greatest interest on sulfite, soda, and kraft pulps, whereas the last-mentioned process finds greatest utility on sulfite, semi-chemical, and fibrous agricultural pulps.

Last stage tower bleaching

Within the structure of the normal bleach plant sequence there is very often a final stage following a hypo stage, which may be utilized to advantage for hydrogen peroxide bleaching. Schematically such a stage is shown in Fig. 1.

This peroxide stage should be preceded by a hypochlorite stage, and for best economy the density should be as high as feasible, that is 15 per cent, which we term moderate density, or even as high as 25 per cent, which we term high density. At higher densities, as is well known, chemical efficiency is increased, the highest brightness level with a given formulation is gained, and greater capacity in terms of tower size results. Steam savings will, of course, increase as density is increased. Temperatures on kraft pulp should generally be in the range of 130-170°F. with bleaching times in the order of one to three hours, depending upon prior treatment and brightness level preceding the peroxide stage and on final brightness desired. The equipment for such a system may be usual equipment which will withstand alkaline pH's up to about 10.7 and, of course, tower construction should be such that it will withstand temperatures up to about 150-170°F.

The yield for this stage is high, brightness of the peroxide last-stage treated pulp is quite stable over the paper machine or pulp dryer, and physical properties of pulp closely approximate those found prior to the peroxide stage.

Becco pulp dryer steep bleach

This process is admirably suited for superbleaching or prevention of brightness reversion in pulp mills that bleach and thicken and/or dry for storage or shipment. There are many mills which fit into this category, and the system has been in commercial operation on sulfite and soda pulps for over one year and recently has been adopted by two kraft mills. Schematically, the system is shown in Fig.2. The wet end may be of the Kamyr or Impco feltless wet machine type, or a cylinder or fourdrinier type; whereas, the dry end may be a steam cylinder or hot air type. Basis weights up to 1200 lbs./3000 sq. ft. have been treated effectively. Ordinarily, hydrogen peroxide in somewhat diluted form is applied following the wet presses in conjunction with pH-controlling alkalis, such as phosphates. An alternate system is to adjust the pulp sheet pH either as it is formed into a sheet or by alkali application prior to the last wet press followed by hydrogen peroxide addition alone. This system is called the "Split-Application" system and permits more thorough alkali penetration into the center of heavy-weight sheet. The peroxide or the single solution con-

Table I—Last Stage Peroxide Tower Results

Pulp	Preliminary Treatment	% Density	Temp. °C.	Time Hrs.	% H_2O_2(50%)	Brightness Original	Brightness Final
Southern pine kraft	3 Cl_2-OH-OCl	12	52	4.5	0.20	78.5	81.1
		25	52	3.5	0.20	78.5	83.2
		29	52	3	0.40	71.9	80.1
	4 Cl_2-OH-OCl-OCl	13	77	3	0.50	80.2	85.3
	5 Cl_2-OH-OCl-OH-OCl	30	52	3	0.50	80.3	86.1

Table II—Pulp Dryer Steep Results

Pulp	Preliminary Stages	% H_2O_2(50%)	Brightness Off Dryers Normal	Brightness Off Dryers Treated	Days	Brightness Aged Normal	Brightness Aged Treated
Southern pine kraft	5	0.60	81.3	86.1	30	78.8	86.9
	5	0.16	84.8	87.8	14	81.7	86.5
	5	0.21	85.3	86.4	14	82.1	87.9
	5	0.22	82.7	85.8	14	82.4	85.0
	5	0.25	85.5	88.1	14	86.2	90.0
	*ClO_2	0.50	87.5	90.6	7	86.4	91.5

Table III—Becco "Hypochlorite-Hydrogen Peroxide" Process

Pulp	Hypochlorite Stg. % Av. Cl_2	Hypochlorite Stg. Time Hrs.	Peroxide Stage % H_2O_2(50%)	Peroxide Stage % Density	Peroxide Stage Time Hrs.	Brightness Original	Brightness Final
N. spruce sulfite	4.0	1	1.00	34.0	3	61.9	86.0
	3.0	1	0.50	35.0	2	59.8	83.7
	3.0	1	1.00	35.0	2	59.8	86.8
	2.5	1	0.85	33.1	2	50.0	85.2
W. hemlock sulfite	3.0	1	1.20	32.0	3	52.9	86.5
NSSC aspen	12.0	2	1.00	10.0	4	52.8	80.3
	10.0	½	1.50	25.0	3	41.9	75.5
Bagasse	4.0	1	2.0	25.0	5	38.4	69.0
	4.0	1	2.0	25.0	3	43.4	69.1

Table IV—Aging of H_2O_2 Bleached Pulps

Pulp	Type of H_2O_2 Bleach	% H_2O_2(50%)	Brightness Original	Brightness Final	Ageing Conditions
S.pine kraft	None	—	78.2	73.1	4 hrs. at 100± 5°C.
	Last Stage Tower Bleach	0.50	84.1	81.4	4 hrs. at 100± 5°C.
	None	—	81.4	81.9	5 days at 50°C.
	Pulp Dryer Steep Bleach	0.40	83.5	85.4	5 days at 50°C.
	None	—	87.5	86.3	5 days at 50°C.
	Pulp Dryer Steep Bleach	0.50	89.9	89.6	5 days at 50°C.

*Manager, Pulp & Paper Research and Development, Becco Chemical Div., Food Machinery & Chemical Corp.
**Chemist, Pulp & Paper Research and Development, Becco.

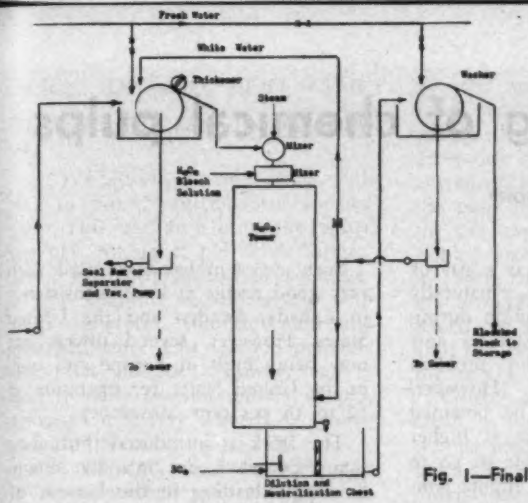


Fig. 1—Final stage H_2O_2 tower bleach

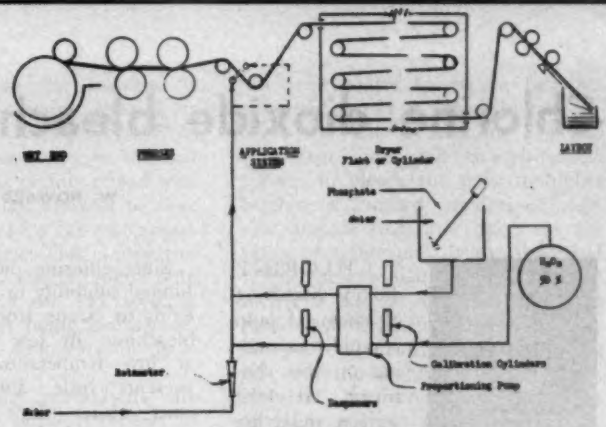


Fig. 2—Pulp dryer steeping

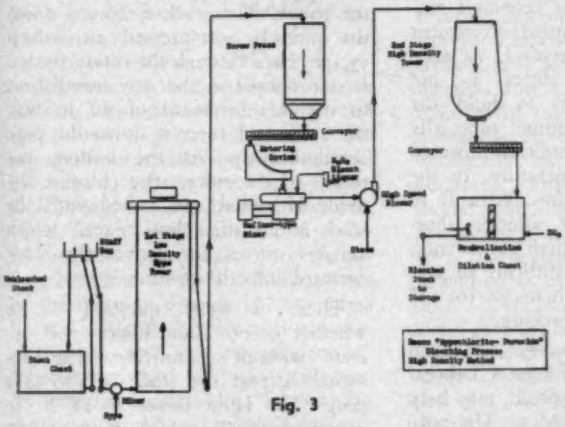


Fig. 3

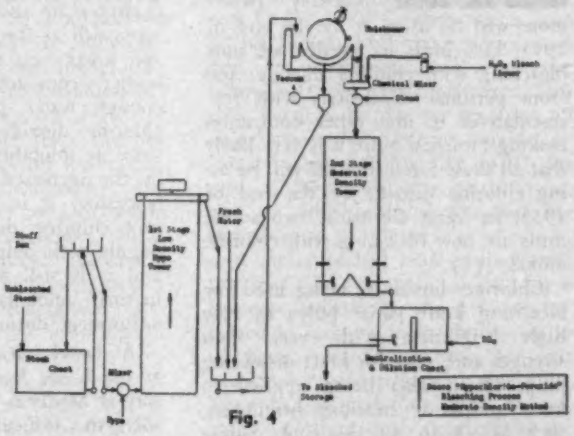


Fig. 4

taining pH-controlling alkali may also be added intermediate or following the dryers as desired.

Through this dryer steep bleach treatment, pulp off the dryer will in some cases approximate headbox brightness to the machine and in many cases will show a higher brightness at this point prior to baling. In contrast to untreated pulp passed over the pulp dryer, which normally loses brightness due to the effects of the heat of the dryer, a net gain is shown compared with the control. Ordinarily, some hydrogen peroxide is present in the pulp at the time of baling, and with proper pH control of the pulp in the bale, brightness stability during storage and shipment is excellent, particularly when compared with untreated control bales. It is well known that the heat effects upon the brightness of baled pulp is most detrimental and the Becco Pulp Dryer Steep system counteracts these effects. Nonetheless, brightness stability or additional superbleaching brightness is also obtained on pulp which has been cooled prior to baling.

The effects of dryer temperatures or pulp density off the machine seem to have but little effect on the results obtainable, and it does not seem to matter whether hot air or steam cylinder dryers are used in conjunction with the dryer steep system. The economical superbleaching range of chemicals is in the order of $1-$3 per ton of pulp. The moisture penalty need be no greater than approximately 100 lbs. of water per ton of dry pulp, and in many cases, depending upon steam availability or machine speed, it is considerably less than this, even when the dryer is operated up to its capacity.

This process is simple to install, chemical-handling equipment being all that is necessary. One of the greatest benefits is that multiple brightness grades may be prepared quickly and at will from a single bleach plant grade by merely turning the system on or off or by varying chemical dosage when operating. No transition pulp need be prepared as is generally the case when a different brightness level is started or finished in the bleach plant. Brightness permanence and super-bleaching for the baled or stored pulp are of particular interest to the industry.

Two-stage hypochlorite — H_2O_2

As pointed out previously, this process finds greatest application on sulfites, semichemical pulps, and fibrous agricultural residues, and is not recommended for southern kraft pulps.

Essentially, this system, first published by Becco in 1951, (H_2O_2 Bleaching of Chemical and Mechanical Pulps; McEwen, R. L.; Sheldon, F. R.; and Nelson, D. H. *TAPPI* Vol. *34*, No. 5, May 1951), consists in a low density first stage hypochlorite having a lower-than-normal starting pH. This generally would run from 30-60 minutes retention at low density in an up-flow tower, and normal starting pH's would be in the range of 9.0 to 9.5. This stage essentially satisfies the oxygen demand of the pulp in an economical fashion, permitting a quick treatment in reasonably small equipment as a preliminary preparation for a hydrogen peroxide stage which follows. Fig. 3 shows, in basic outline, the high density system, and Fig. 4 schematically shows the same sequence with a moderate density second stage for peroxide.

As an alternative to the hypochlorite stage described, a Hooker chlorination hypochlorite sequence may be used prior to the peroxide stage. Results obtained by this sequence appear comparable to a low density hypochlorite, although somewhat more equipment would be necessary and an additional bleached yield loss of approximately

(Continued on page 1007)

Chlorine dioxide bleaching of chemical pulps

W. HOWARD RAPSON*

CHLORINE dioxide bleaching of chemical pulp is rapidly expanding on this continent. At least sixteen mills are now using chlorine dioxide, and probably twelve more will be using it by the end of 1955. Five mills in Sweden are now bleaching with chlorine dioxide, and from personal discussions with representatives of the other companies making bleached pulp, it is very likely that all these Swedish mills will be using chlorine dioxide by the end of 1955. In West Germany, two sulfite mills are now bleaching with chlorine dioxide (1).

Chlorine dioxide is being used for bleaching kraft paper pulps to very high brightness with very high strength and, also, for kraft dissolving pulps. It is also being applied to kraft pulps of medium brightness, such as 78 to 80 per cent. Sulfite dissolving pulps are being bleached with chlorine dioxide in Canada, the United States, Sweden and West Germany, and sulfite paper pulps are being bleached with chlorine dioxide in the last three countries.

This widespread application of chlorine dioxide for bleaching such a wide variety of pulps may be attributed to its rather unique ability to oxidize lignin to water-soluble, colorless compounds, without appreciably affecting the cellulose, provided suitable conditions are used. For instance, at pH 3 to 5 chlorine dioxide does not noticeably lower the viscosity of cellulose, does not change its copper number, and does not alter its caustic soda solubility (2). From these three facts, we may conclude that it does not rupture the 1.4 B-glucosidic linkages in the cellulose molecule, it does not oxidize existing aldehyde or ketone groups to carboxyl, and it does not form new aldehyde or ketone groups. Since chlorine dioxide oxidizes both lignin and resin to colorless substances, it will bleach pulp for paper without loss of strength and will purify dissolving pulps for making viscose, plastics, or acetate, without degrading the cellulose.

*Professor of Chemical Engineering, University of Toronto.

Since chlorine dioxide is a gas of limited solubility in water, it naturally tends to escape from solution during bleaching. At low consistencies and at low temperatures, this problem presents little difficulty. However, since whiter pulps can be obtained by using chlorine dioxide at higher temperatures, it is desirable to go to higher consistencies when higher temperatures are used, for economic reasons such as lower capital investment and lower heat requirement. At such higher consistencies there is not enough water present to hold the chlorine dioxide solution, especially since its solubility is radically lowered by the increased temperature. In the laboratory it is therefore difficult to mix chlorine dioxide solution thoroughly with pulp at high consistency, and it is still more difficult to mix in small amounts of chemicals for pH adjustment during bleaching.

A novel idea recently developed at the U. S. Forest Products Laboratory at Madison, Wisconsin, may help solve this difficult problem. The pulp is placed in a polythene bag, the neck is tightly gathered together, the air is expelled by squeezing, and a pipette containing the chlorine dioxide solution is inserted through the squeezed-down neck. After draining, the pipette is slipped out of the neck of the bag without allowing any chlorine dioxide to escape, the neck is twisted, and an elastic band is tightly placed around it. The pulp and liquid may be kneaded by hand and thereby thoroughly mixed, without allowing any chlorine dioxide to escape. The bag and contents may then be placed in a bath at any suitable temperature and weighted, if necessary, to hold it down. Periodically the bag may be removed and kneaded to mix the pulp and solution.

Newest tower design

The ideal way to overcome the problem of escape of chlorine dioxide would seem to be to provide the whole retention time in a high density upflow tower. The chlorine dioxide should be mixed with the pulp at the entrance to the tower. This should retain the chlorine dioxide in the stock until it has travelled up the tower, and the problem of escape of chlorine dioxide and of explosion should be completely eliminated.

Such a system has been used with very good results at lower consistency in Canada, Sweden and the United States. However, several towers are now being built in Europe and one, in the United States for operation at 12 to 15 per cent consistency.

The stock is introduced through a rotary pocket feeder into the downflow pipe leading to the bottom of the tower. The stock is forced down the pipe by compressed air, which escapes back through the rotary feeder. It is proposed in the new installation to use steam instead of air to heat the stock and force it down the pipe simultaneously. At the bottom entrance to the tower, the chlorine dioxide is added and mixed with the stock in a "radial flow mixer," which agitates, mixes and moves the stock forward into the tower.

There is some question as to whether or not these towers will operate without channeling. The designers expect the stock to rise as a plug. The latest tower is 18 ft. in diameter and 75 ft. high. If this tower operates successfully, it is almost certain that smaller ones will too. This type of equipment should overcome many of the problems associated with chlorine dioxode bleaching of pulp on a mill scale.

Optimum conditions for bleaching

What are the optimum conditions for treating pulp with chlorine dioxide to obtain maximum brightness with least loss of strength? To answer this question we have in progress a thorough study of the interrelated effects of the variables — time, temperature, chlorine dioxide to pulp ratio, consistency and pH — for both sulfite and kraft pulps. Some results obtained to date in this continuing investigation will be indicated, but much further experimentation will have to be carried out for confirmation before the trends can be accepted as established facts. The experimental data will be published when the investigation is complete.

The effect of pH is very important in chlorine dioxide bleaching. It affects four different chemical reactions which must be taken into account.

(1) Chlorine dioxide reacts with hydroxyl ions to form chlorate and chlorite ions:—

$$2ClO_2 + 2OH \rightarrow ClO_3^- + ClO_2^- + H_2O$$

This reaction is faster the higher the pH.

(2) Chlorine dioxide reacts with pulp to form chlorite ions and bleached pulp. This reaction is faster the higher the pH. At higher pH levels this reaction lowers the viscosity of cellulose.

(3) Chlorine dioxide reacts with pulp to form chloride ions and bleached pulp. This reaction probably does not degrade cellulose, and it may possibly be independent of pH, although it is very difficult to investigate this point.

(4) Chlorite ions react with pulp to form bleached pulp and chloride. This reaction is faster the lower the pH, and does not take place to any appreciable extent above pH 7.

Reaction (1) is a waste of chlorine dioxide, since neither the chlorate nor the chlorite ions are effective oxidizing agents under alkaline conditions. If the pulp suspension were subsequently acidified, the chlorite could be activated to undergo reaction (4). Reaction (2) is quite effective for bleaching, but part of the oxidizing power of the chlorine dioxide is lost, unless the stock is subsequently acidified. Reaction (3) and (4) are efficient reactions; however, they are different, for chlorine dioxide does not oxidize the keto groups in cellulose to carboxyl, while acidified chlorite ions do (2).

The whole question of pH during chlorine dioxide bleaching has received relatively little attention in the literature. This is probably due to the technical difficulties involved in carrying out experiments with chlorine dioxide at controlled pH. During bleaching, chlorine dioxide consumes hydroxyl ions by reaction (1) and forms acidic substances by reaction with the impurities in pulp. Reaction between chlorite and the keto groups in cellulose also tends to increase the acidity, and the pH tends to drop. Therefore, if it is desired to maintain the pH at some particular level, it is necessary to add alkali at frequent intervals, or to add a buffer system, which will maintain the pH at the desired level. The chlorine dioxide tends to escape from the solution when the alkali is added and mixed with the pulp.

Another difficulty arises from the fact that the pH must not be allowed to rise too high at any time during the chlorine dioxide bleaching, even locally, or reactions (1) and (2) are speeded up. Not only does the rate of reaction between chlorine dioxide and the impurities increase, but the chlorine dioxide begins to attack the cellulose also. If the pH is above 9.5 or 10, the attack on the cellulose is rapid, and the chlorine dioxide is consumed rather quickly. Therefore, great care must be taken to see that any added alkali is rapidly mixed with the pulp and is not allowed to raise the pH, even locally, for any appreciable length of time. This is necessary to ensure that any effects on the pulp are attributable to the pH level at which the stock is being maintained, and not to any temporary or local higher pH.

When adequate precautions are taken in carrying out experiments in the laboratory, it is found that pH has a very important effect on chlorine dioxide bleaching. As the pH drops below 7, the rate of reaction between chlorine dioxide and the pulp decreases; and longer time, higher consistency, and higher temperatures are required to reach the same degree of bleaching. As the pH rises, the rate of reaction increases; and lower temperatures, lower consistencies and shorter times may be used to obtain the same level of brightness. However, this increased rate of reaction is accompanied by an increasing degree of oxidative degradation of the cellulose, as manifested by lowering of viscosity. No serious lowering of viscosity is found below about pH 5, and the lowering is slight up to about pH 8. Above this the degradation of the cellulose increases rapidly and extensive damage may be done if the pH is allowed to rise above 10 or so.

It will be noted that this is quite opposite to the effect of pH on hypochlorite bleaching. With hypochlorite the rate of reaction is very slow at the very high pH and increases as the pH drops. The degrading effect of hypochlorite on the cellulose is not too serious above pH 10, but below this the rate of attack increases. In the neutral range between pH 5 and 7.5 the rate of degradation of cellulose by hypochlorite is extremely rapid. It decreases again as the pH drops below 5, due to the displacement of the equilibrium between hypochlorous acid and chlorine in favour of chlorine at lower pH levels. Therefore, at pH 2 or less the damage to cellulose is small because the concentration of hypochlorite ions is very low.

In our experiments the brightness level obtained with a given pulp in the presence of a limited amount of chlorine dioxide, at fixed temperature, consistency and time, varied with the pH, reaching a maximum about pH 6 and dropping at higher pH. With an excess of chlorine dioxide with a sulfite pulp, in one series of experiments there was a peak at pH 8. This can be accounted for by the fact that although at pH 8 some chlorine dioxide was lost by reactions (1) and (2), there was still enough excess present to bleach the pulp to higher brightness. Limited amounts of chlorine dioxide had little effect on viscosity of sulfite pulp below about pH 7, but there was an appreciable drop at pH 8 and 9. With an excess of chlorine dioxide, the drop in viscosity increased gradually with increasing pH, showing a sharp drop at pH 9. However, the drop in viscosity was relatively small in all cases.

The effect of time on ClO_2 bleaching at the optimum pH 6 is interesting. On a sulfite pulp, with 0.5 per cent ClO_2, at 60° C., there was a drop in brightness after three hours at 6 per cent consistency and after four hours at 10 per cent consistency. This may possibly be due to reversion in color when the chlorine dioxide residual became too low. At 40° C. the rate of brightness was much lower, and no drop in brightness was observed up to five hours.

A semi-bleached kraft pulp with 1 per cent ClO_2 on pulp, at 60° C., 6 per cent consistency, and pH 4.5 continued to increase in brightness up to six hours, and longer time than this has not yet been tried with this pulp. Time had a negligible effect on viscosity. A slight drop occurred in the first hour, but the fluctuations after that were probably within the experimental error.

In studying the effect of increasing ratio of chlorine dioxide to pulp on brightness achieved in a given time, it was rather surprising to find repeatedly that larger amounts of chlorine dioxide (above about 0.6 per cent on pulp) gave lower brightness. No explanation for this observation is offered at the present time. The effect of increasing chlorine dioxide to pulp ratio on pulp viscosity was relatively small.

Contrary to most other bleaching processes, higher consistency does not speed up the reaction between chlorine dioxide and pulp, because of the limited solubility of chlorine dioxide in water. As the consistency rises, the water-pulp ratio decreases, and the concentration of the chlorine dioxide must rise if the same chlorine dioxide pulp ratio is to be maintained. If the solubility of the chlorine dioxide at the temperature being used is exceeded, the chlorine dioxide will pass into the vapor phase and will return to the liquid phase as the remaining chlorine dioxide is consumed by the pulp. This diffusion takes time, and there is the risk of some chlorine dioxide escaping to the atmosphere.

Therefore, in general, the results at 6 per cent consistency are as good as those at 12 per cent, all other conditions being the same. Therefore, it is a reasonable assumption that experiments carried out at 6 per cent consistency can be duplicated at 12 per cent consistency in the mill in an upflow tower, but in the laboratory it is much easier to work at the lower consistency.

It is relatively easy to produce a fairly white pulp with chlorine dioxide in one stage without paying too much attention to the finer details of the process. However, when the ultimate 1, 2, or 3 points in brightness are desired, the conditions have to be very precise. If further investigation confirms our results to date, sufficient chlorine dioxide must be used to maintain a slight residual until the end of the treatment time or off-peak brightness will be obtained. However, too much excess chlorine dioxide must not be used or, again, the brightness may be lowered slightly. The temperature must be as high as can be used and still retain the chlorine dioxide in solution. The time must be long enough to reach maximum brightness, but must not be long enough to cause it to drop below this peak by consuming all the chlorine dioxide.

The maximum brightness with a limited amount of chlorine dioxide seems to be achieved at about pH 6. In practice, in a continuous tower in a mill, it is difficult to maintain this pH level. If sufficient alkali is added before entering to have pH 6 at the exit from the tower, the pH will be too high at the beginning, since the pH drops during treatment. This difficulty might be overcome by addition of buffering agents, but the cost of these is too great. In a batch system, of course, it is possible to add alkali at intervals to keep the pH at the right level, but even this is not too simple to achieve without having locally high pH. Therefore, it may not be practical to utilize the pH conditions found to be optimum, although an attempt should be made to approach them as closely as possible.

Two ClO_2 stages needed for maximum brightness

Some of the optimum conditions are incompatible; and, therefore, maximum possible brightness cannot be achieved in a single stage with chlorine dioxide alone. In order to use high temperature which gives better results, it is necessary for economic reasons to use high consistency. High consistency means low water to pulp ratio, and the limited solubility of chlorine dioxide at high temperatures limits the amount of chlorine dioxide which can be put into the pulp. Furthermore, too much chlorine dioxide appears to cause lower maximum brightness under some conditions. One solution to these problems would seem to be to use the chlorine dioxide in two stages, and this is being practiced in some mills and planned in others.

It is interesting that we have come to the conclusion that at least two stages of chlorine dioxide are necessary for highest brightness levels. By applying the optimum conditions for each chlorine dioxide stage, it is possible to obtain maximum brightness with minimum loss of strength, with maximum color stability and minimum dirt count, economically, in five stages without hypochlorite: chlorination, caustic extraction, chlorine dioxide, caustic extraction and chlorine dioxide. A kraft bleach plant was started recently with this sequence of stages.

Maximum brightness has been achieved in several other ways involving chlorine dioxide followed by other stages with other chemicals. One way is to follow the chlorine dioxide treatment with a very light hypochlorite treatment which seems to oxidize these last traces of colored material and to give maximum possible brightness. This procedure is disclosed in a patent by the author, assigned to Canadian International Paper Company (3). This procedure has several advantages. The hypochlorite may be used after a chlorine dioxide treatment which is either acid, neutral, or slightly alkaline, with equally good results. The chlorine dioxide treatment may be carried out at lower temperature and for shorter time and still give the maximum brightness after hypochlorite treatment. Equally good results are obtained whether the pulp is washed after the chlorine dioxide treatment or not. In batch bleaching the chlorine dioxide treatment can be followed by the hypochlorite treatment in the same vessel. It has the disadvantage that the hypochlorite treatment lowers the viscosity of the pulp to some extent. Fortunately, the amount of hypochlorite required to obtain the higher brightness is very small and the loss of strength is therefore slight.

Another method for obtaining maximum brightness is disclosed in patents by Vincent (4), and Collin and Jonsson (5). The chlorine dioxide treatment is carried out in neutral or slightly alkaline solution, and then the stock is acidified to pH 4-4.5 and the heating is continued. On acidification, the chlorite formed from the chlorine dioxide on the slightly alkaline side is activated and completes the bleaching of the pulp by reaction 4 above. This process gives very good results, but great care must be taken not to have the pH of the pulp too high during the chlorine dioxide treatment, and the later acidification to the right pH is a little difficult to accomplish.

Bleaching at lower brightness

So far we have been discussing the means of achieving the maximum possible brightness. However, many mills to-day do not require the ultimate in brightness. Very often they will be satisfied to reach a lower brightness without loss of strength. A level of about 80 per cent brightness can be achieved, of course, with multi-stage hypochlorite bleaching without chlorine dioxide, with a relatively small loss in strength. In spite of this, chlorine dioxide is being used for low brightness in at least one kraft mill to-day and is being planned in others. It is claimed that by using only four stages with chlorine dioxide, for example, chlorination, caustic extraction, hypochlorite, and chlorine dioxide, 80 per cent brightness can be achieved without loss of strength, while it may be necessary to go to seven stages if this is to be accomplished with hypochlorite alone, with small loss in strength. It is said that for a new bleach plant the saving capital cost for the extra three stages, with all their washers and auxiliary equipment, more than offsets any slight additional cost there may be for the chlorine dioxide.

One mill is using only three stages, including chlorine dioxide for bleaching a kraft pulp to 78 per cent brightness, omitting the caustic extraction stage. It is claimed in that mill that the cost of bleaching is less, the yield in pulp is a little higher, the pulp is cleaner and there is less reversion, with the same opacity, than with standard bleaching methods. It is also claimed that, due to omission of the caustic stage, the effluent from the bleach plant causes less stream pollution, has lower b.o.d., is lighter in color and has less foam. These are benefits one would not normally look for in connection with chlorine dioxide bleaching, but they are probably none the less real.

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Multi-stage bleaching of kraft pulp

GEORGE SEYMOUR*

BRUNSWICK Pulp & Paper Co. has bleached southern pine to 88 and even 90 brightness with five stages using only chlorine, caustic and hypochlorite for bleaching agents. This is done without undue strength loss; in fact, we lose only 10 per cent of the original brown pulp strength through bleaching.

Secondly, and this will interest the advocates of super-bleaching agents such as chlorine dioxide and peroxides, we do have a reversion problem and are delivering pulp at the 84 brightness level.

Third, we are taking steps which will reduce the brightness loss considerably. These three statements show that there are plenty of opportunities in bleaching for the cheapest known bleaching agents, chlorine and calcium hypochlorite. Also, there is much we do not know about hypochlorite bleaching, nor have we reached the brightness limits, although it has been stated by many authorities that hypochlorite is no good over 83 to 85 brightness.

Rules of hypochlorite bleaching

Let me briefly state the few rules we do know about hypochlorite bleaching in a multi-stage system. There are six important variables to be controlled, and I will list them inversely to their importance in a hypo stage.

Sixth is reaction time. This can be set at about two hours and left there so long as the remaining variables are within the prescribed limits.

Fifth, pulp density needs to be controlled only to the extent of keeping the operations uniform and high enough to prevent channeling in Kamyr type towers.

Fourth, temperature should be kept at a minimum to produce the brightness desired at the end of the stage.

Third, the pH must be held within narrow limits to prevent strength loss, when the pH is too low, and to prevent underbleaching when too high.

Second, in importance is the control of the residual available chlorine at the end of the hypo stage.

*Brunswick Pulp & Paper Co., Brunswick, Ga.

All of these variables are important and possibly should not be put in an order of importance. That is why I have left first in this list for "uniformity," or the right combination of all the preceding variables.

Let us take a closer look at these variables, keeping in mind that brightness or pulp purity is the goal and has a set value and is therefore not a variable. This time we will take them in the proper order, starting with residual available chlorine. It has long been known that pulp will lose brightness if left to stand in a stage without a residual bleaching force. There are in effect two reactions going on during a bleach stage. The first is bleaching, the second reversion. When the residual chlorine content goes below about 0.2 per cent on a basis of the pulp, reversion is going faster than bleaching, and brightness is lost, requiring additional chemicals to bring it back in a later stage. Secondly, the later stage will be working overtime and cause more degradation or strength loss to the pulp. This is not the only strength loss due to a lost residual for, as the residual goes down, the pH also drifts down, and it is very surprising how much damage can be done to pulp strength by the remaining 0.2 per cent av. Cl_2 at a pH of 7.0. Well, it looks like we slid right into the pH variable from residuals, so let us continue on it for a while. It has long been known that hypochlorite in the neutral pH range is damaging to pulp. It is also known that at pH 11 and above the bleaching action of hypochlorite is very slow and barely overpowers the ever present reversion reaction. Consequently, the most desirable end pH for a hypochlorite stage is about half way between, or at 9.0.

It is very impractical to change reaction time in a continuous process; therefore, the speed of the bleaching reaction is controlled by temperature. Temperature is the No. 1 control in obtaining the desired brightness when all other variables are within their prescribed limits, but since the temperature is so easily controlled by instrumentation, I have considered it in fourth place.

Pulp density is such a small factor in bleaching within the limits which we can vary with our present installed equipment that it should probably be left out of this discussion. There is, however, one point which should be made, namely that the density must be held high enough to prevent channeling in high density towers.

It may be well to point out that when channeling does occur the following is a list of symptoms which accompany it:

1. Low brightness following this stage.
2. High pH and residual chlorine.
3. Poorly formed cone in tower.
4. Edges of cone are flat.

Last on the list of variables, we again come to retention or reaction time. Some mills have as low as 1 hour reaction time and others have as much as 4 hours for a hypochlorite stage. In my opinion 2 hours is sufficient and, with the proper control of the other variables, will give consistently good results.

Chlorination, caustic extraction

All the preceding discussion will apply to any high density hypochlorite stage. The other stages and sequences vary from mill to mill but generally include chlorination and caustic extraction stages. The chlorination stage is simple. Apply all the chlorine the pulp will absorb in 1-hour and still have from 0.1-0.2 per cent residual chlorine at the end. This brings up one point which must be mentioned, and that is mixing. Mixing is not a variable and must not be a variable. Mixing must be thorough and complete in any and all stages to produce high quality, low-cost pulp. Inadequate mixing can cause low strength, low brightness, shives, unbleached wood dirt, and excessive chemical usage.

Caustic extraction stages are also easily controlled. The per cent caustic applied and temperature must be determined for each pulp depending on the brightness and brightness stability required.

Number of bleaching stages

High brightness with good brightness stability cannot be produced on pine kraft pulp with less than four stages, and better strength and brightness stabiliy can be made using five stages. One stage can only accomplish a certain amount of purification without excess strength loss. As men-

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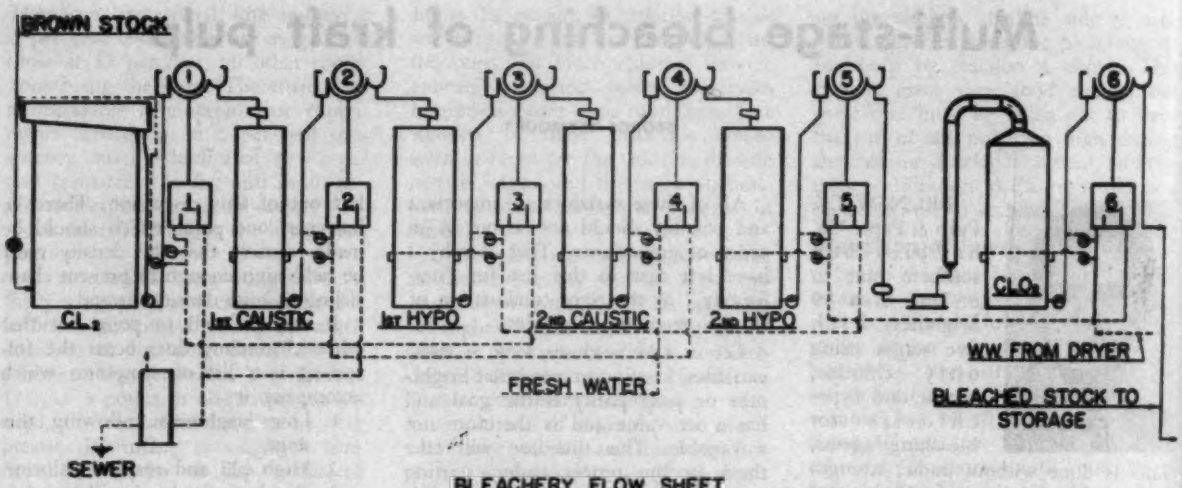

BLEACHERY FLOW SHEET

The bleaching of kraft pulps

A. L. WILEY*

MODERN METHODS for bleaching kraft pulp follow a sequence of stage reactions; namely, chlorination, alkali extraction, hypochlorite and, finally, either an acid extraction or a super bleaching stage.

The number of stages and sequence arrangements for a specific bleaching process is dictated by the chemical and physical characteristics required in the end product.

The six-stage bleaching sequence presently in use at the Riegel Carolina Corp. mill is described in this paper. However, in the manufacture of bleached kraft pulps, an important step, digester control, should be considered briefly because the key to a successful continuous bleaching operation is the uniformity of the unbleached pulp.

Variables affecting stock uniformity

Some of the variables affecting the uniformity of stock from kraft digestion are well known; therefore, they will be mentioned here only to indicate their influence on quality cooking and the end product.

1. *Raw Material Variables:*
   - A. Wood Age: Affects yield, penetration and reaction rates.
   - B. Chip Length and Degree of Uniformity: Affects yield and strength properties.
   - C. Chip Cleanliness: Affects speck count of the end product.
   - D. Chip Moisture: Affects reaction rate and water ratio.
2. *Reaction Variables:*
   - A. Active Chemical to Oven-Dry Wood: Affects yield, bleachability and rate of pulping.
   - B. Sulfidity: Affects yield, bleachability and physical properties.
   - C. Maximum Temperature: Affects reaction rate, yield, bleachability and physical properties.
   - D. Time at Maximum Temperature: Affects yield, bleachability, physical properties, pulping rate and liquor ratio.
   - E. Liquor Ratio to Oven-Dry Wood: Affects yield, bleachability and chemical concentration.

The reaction rate of a raw material at any point in a chemical pulping system varies with the active chemical concentration and the absolute temperature. Therefore, nothing but the ultimate in circulation of the active chemical with an even distribution of heat can be accepted in a digester without sacrificing uniformity of the product.

Riegel Carolina is equipped with six 3300-cu. ft. capacity, vertical-type digesters for kraft pulping.

Each pressure vessel is equipped with automatic pressure cooking and gas-off controllers which regulate the steam input and relieve non-condensable gases automatically. Forced circulation is provided for each unit. Discharge lines from the circulation pumps are piped to the top and bottom of each digester in a conventional manner. The rate of top and bottom circulation is adjusted with manual gate valves by referring to temperature bulbs installed in the digester shell at the top, middle, and bottom elevations. Direct steam heating is used for cooking, and the steam is applied at the cone section through four 4-in. Inconel sparger type nozzles.

The washing and screening operations are of conventional design in that washing is done on four-stage rotary type vacuum washers operated as a counter-current flow system, and brown stock screening is carried out on five rows of primary and two rows of secondary stainless steel flat plate type "E" channels. The screened stock is thickened on a valveless type decker, and the discharge cake is diluted to a consistency of 3.5 per cent as it drops into the screened stock chest by gravity.

Effects of bleaching variables

A bleaching process is a chemical reaction involving organic and inorganic components; namely, cellulose and chlorine compounds with many variables affecting the reaction rate. The effects of pH, temperature, consistency, chemical concentration, contact time and stock flow are important variables in a bleaching process involving cellulose and chlorine solutions. Therefore, optimum control of these variables is a dire necessity for the production of a high quality product. The variables, pH and temperature, exert great influence on the physical properties of a bleached product. It is desirable to briefly review their reaction effects.

1. *pH:* Bleaching studies carried out at various pH levels indicate the following:
   - A. pH 1.0-1.5: Elemental chlorine predominates.
   - B. pH 2.0-4.0: Chlorine-hypochlorous acid.
   - C. pH 4.0-7.0: Hypochlorous acid predominates.

*Riegel Carolina Corp., Acme, N. C.

D. pH 7.0-9.0: Hypochlorous acid-hypochlorite.

E. pH 9.0-11.0: Hypochlorite.

At pH 7.0, alkaline hypochlorite solutions spontaneously decompose. Chlorination is best when controlled at pH 1.5-2.0. Bleaching conditions are optimum at pH 8.5-10.0.

2. *Temperature:* The effect of temperature in a bleaching process is second only to pH with regard to reaction velocity and its effect on the physical and chemical characteristics of the end product. Investigations regarding rate of decomposition have shown that an increase in temperature of 7.5°C doubles the rate of decomposition.

Temperatures in excess of 115°F cause degradation of the stock and loss of oxidizing chemicals in the hypochlorite stages. On the other hand, low temperatures prolong bleaching time unnecessarily. Generally, a higher temperature can be tolerated better in a low density bleaching system than in a high density system. Temperature affects both the physical and chemical characteristics of cellulose in the presence of chlorine or chlorine derivatives.

Fundamental processes in bleaching

The fundamental processes employed in a bleaching system involve chlorination, alkali extraction, hypochlorite treatment and variations in washing and acid treatment stages. Chlorine dioxide, peroxide and chlorites are generally coming into use where high color is desirable.

1. *Chlorination Treatment.* At low pH values, the reaction is fast. About 15-20 minutes is required for two-thirds of the total bleach demand to be consumed. First, the reaction is one of substitution and addition. This accounts for the hydrochloric acid formation in a chlorination stage. Over-chlorination of cellulose results in oxidation and degradation. Each chlorine number or hardness number, as measured by permanganate test, has an optimum degree of chlorination. If chlorine is applied in excess of that required for the incrustants, damaged cellulose will result. Consistencies of chlorination range from 3-5 per cent. Chlorination pH is 1.5-2.0. The optimum temperature for chlorination is 70-85°F. Reaction time will vary from 30-90 minutes.

2. *Alkali Treatment.* The purpose of alkali treatment is to make soluble the chlorinated lignin produced in the chlorination stage. Full extraction will usually be obtained at 2.5 per cent caustic treatment by weight. Retention time will vary from 30-60 minutes. Temperature of extraction will vary from 130-180°F.

3. *Hypochlorite Treatment.* The function of a hypochlorite treatment primarily is to remove by oxidation the color bodies remaining after the preceding steps of pulp purification. Bleach concentration, pH, temperature, and consistency must be carefully applied and controlled to produce optimum results. High consistency hypochlorite stages reduce shives. Sodium hypochlorite is preferable to calcium hypochlorite in high density bleaching.

4. *Chlorine Dioxide Treatment.* The following advantages are recognized in the production of high color kraft pulps with chlorine dioxide:

A. Removes the final lignin which improves the color.

B. Improves yield of the end product from a bleaching operation.

C. Reduces quantity of hypo and caustic.

D. Smoothes out variables of bleach plant operation for easier control.

E. Improves fiber reactivity and chemical and physical properties.

Riegel Carolina bleach plant

1. *Chlorination Stage.* Beginning as the brown stock enters the bleach plant under controlled consistency, the rate is set by means of a conventional, displacement type stock meter. Effluent from the meter box drops by gravity into a chlorinator equipped with both internal and external mixing circulators. Chlorine in the vapor state is applied to the stock at one or more points in the external circulator. Chlorination is carried out at low density, 3.5 per cent, in an up-flow type tower which is lined with acid resistant brick and pointed with an acid resistant material. The chlorinated stock discharges from the chlorinator through a launder circumscribing the chlorinator. Top agitation is provided to prevent floatation and promote an even flow over the weir section of the launder, thereby minimizing channeling. The chlorinated pulp drops by gravity to the stock pump which delivers it to an 8- by 10-ft rubber-covered washer where the acid soluble materials are removed through dilution and displacement washing. A minimum of two-thirds the total chlorine requirement is carried out in this stage. Temperature of chlorination is 85°F. Reaction time is 45-60 minutes dependent upon the rate.

2. *Caustic Extraction Stage.* The washed chlorinated stock is treated with caustic soda just as it drops into the shredder. Heat is applied to the stock by adding steam to a double-shaft mixer located under the re-pulper section of the chlorination washer. The caustic extraction stage is run at high density, 14-16 per cent. Extraction temperature is 150°F. Reaction time is 45-60 minutes. Ultimate pH is 10.5-11.0.

Dilution water is added to the bottom of the tower to reduce the consistency of the pulp to 3.5 per cent. The tower is equipped with side agitation which mixes the stock and water to a pumping consistency. The extracted stock is pumped to an 8- by 10-ft. cast iron washer where the soluble chloro-lignins and oxidized products are removed by dilution and displacement washing.

3. *Hypochlorite Stage.* Sodium hypochlorite is applied to the discharge cake similar to that in the caustic extraction stage. Hypochlorite bleaching is carried out at high consistencies of 14-16 per cent. Reaction time is 2.0-2.5 hours. Ultimate pH is 9.5-10.0. Sufficient bleach is applied to produce a 60.0 color at this point. Temperature of this stage is 95°F.

The second caustic and second hypochlorite stages are operated in a like manner to the ones above. Optimum color for the second hypochlorite stage is 70.0 per cent.

4. *Chlorine Dioxide Stage.* Stock leaving the second hypochlorite washer at 14 per cent consistency drops into a high density stock pump which discharges into the chlorine dioxide mixer where the aqueous solution of chlorine dioxide is thoroughly mixed with the pulp. The treated stock discharging from the mixer enters a pre-retention leg which provides pressure diffusion of the chlorine dioxide into the stock before it drops into the top of the chlorine dioxide bleach cell. Consistency of chlorine dioxide stage is 10-11 per cent. Steam is applied to the stock between the discharge of the thick stock pump and the mixer. Retention period will vary between 2.5-3.0 hours. Temperature of reaction is 150-160°F.

Sulfur dioxide is applied to the dilution ring water to reduce the chlorine dioxide solution preparatory to washing. Stock consistency leaving the chlorine dioxide washer is reduced to 3.5 per cent, and caustic soda is applied to adjust the pH to the neutral point as it drops into the machine chest.

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Bleaching NSSC pulp*

GERALD HAYWOOD**

IN ORDER TO PRODUCE economically a high quality bleached NSSC pulp, the unbleached pulp should meet these specifications: (a) maximum yield at minimum bleachability; (b) be uniformly defibered, i.e., contain a minimum of fiber bundles and of cut fibers; (c) be as free as possible. Process conditions that contribute most to these specifications are (a) small, uniform chips, 3/8-5/8 in. in length of cut; (b) uniform penetration of cooking liquor into chips; (c) high temperature and high consistency of stock during defiberizing step. Oversize chips are the primary cause of dark centers. Dark centers can approximate raw wood in firmness and lignin content and therefore require more power to defiberize, with the resultant formation of fiber clumps. These fiber clumps have a much higher chlorine demand than the fibers from the well-cooked surface of the chips. All this adds up to a non-uniform pulp that is slow and difficult to wash, and this type of stock tends to become progressively slower as it moves through the bleaching sequence.

Measure of bleachability of NSSC pulp

The chlorine demand of unbleached NSSC pulp is determined by a modified $KMnO_4$ test, using 200 cc. N/10 $KMnO_4$ as outlined in TAPPI method RC242.

There is a relation between the RC242 number and the chlorine needed in the chlorination stage that will yield a pulp after caustic extraction with a conventional $KMnO_4$ number of 4.0. There is also a fair relation between lignin content and the RC 242 number as indicated in Table I.

Unbleached NSSC pulps can be bleached by either a single stage of hypochlorite or peroxide, or by a multi-stage sequence of chlorination, caustic extraction, and hypochlorite.

Single stage hypochlorite

Unbleached pulps from Canadian poplar and birch wood were bleached with a single stage of hypochlorite, with the results shown in Table II.

These data show that only a portion of the lignin is removed by the hypochlorite, and that the brightness development is not good. Due to the lignin in the bleached pulp, there is a tendency for the pulp to revert in color on standing. Sodium silicate has been suggested as a buffer when bleaching NSSC pulps by a single hypochlorite stage. Single stage bleaching has a cost advantage over multi-stage bleaching because the cost of bleaching chemicals is less and the loss of yield due to bleaching is under 5 per cent, but multi-stage bleaching yields a brighter, stronger and more versatile pulp.

There is a slight increase in strength over the unbleached strength due to bleaching with a single stage of hypochlorite.

Peroxide bleaching

Unbleached NSSC pulp can be increased up to 10 points in brightness by bleaching with 2 per cent Na_2O_2 in a single stage. The cost of the peroxide and the stabilizing chemicals make this procedure of little utility except in special cases.

Multi-stage bleaching

Unbleached NSSC pulp can be bleached to 85 per cent brightness by the following three-stage sequence.

Table I

RC242 No.	% Cl_2 on O.D. Pulp to be applied in chlorination stage	% Lignin
51	7.6	5.36
53.5	8.2	5.67
58	9.3	6.31
61	10.0	6.44
68	11.7	7.05
70	12.3	7.30
79	14.5	7.83
83.5	15.5	8.23
86.5	16 3	8.53
88	16.7	8.77
91.5	17.5	9.39
94	17.8	9.65
98	19.1	10.09

Caustic extraction

The purpose of caustic extraction is to solubilize the chlorinated lignin. The solubility of the lignin in the chlorinated pulp is a function of how thoroughly it has been chlorinated. One of the problems in caustic extraction is the difficulty of washing hydrochloric acid out of the chlorinated pulp. When free acid is left in the pulp entering the caustic extraction stage, an abnormal amount of caustic soda is needed to neutralize the free acid in the pulp. The optimum conditions are: (a) pH 10-11; (b) temperature, 60-70°C.; (c) consistency, 13-14 per cent. When chlorination has been thorough it is possible to obtain pulp with a $KMnO_4$ No. of 4.0 and a hypochlorite chlorine demand of 2.0 per cent in the pulp leaving the caustic extraction stage.

Stage	Name	Active Chemical	Consistency %	pH	Temperature °C.	Time minutes
1	Chlorination	Cl_2	1.5 to 3.5	1.5-2.0	25	30- 60
2	Caustic extraction	NaOH	13 to 14	10-11	60	60- 80
3	Hypochlorite	$Ca(OCl)_2$	3 to 14	8-9	32	60-180

Table II

	Unbleached Canadian Poplar 1	Unbleached Canadian Poplar 2	Unbleached Birch
Consistency, %	10.4	10.4	12.5
Temperature, °C.	32	32	32
Time, hrs.	3	3	3
Cl_2, as $Ca(OCl)_2$, %	9	10	10
CaO, as buffer, %	.72	1.96	2
Brightness	52	60	62.6
Lignin, in unblea. pulp, %	8.3	8.3	—
Lignin, in blea. pulp, %	4.3	4.5	—

Chlorination

The optimum temperature for the chlorination stage is 20-30°C., but in order to have uniform bleaching conditions the year around, it is best to standardize on the summer temperature of the water available to the bleaching sequence. The consistency in the chlorination stage depends on whether liquid chlorine or chlorine water is used. The reaction between elemental chlorine in water solution and lignin in the pulp is extremely rapid and the reaction is complete in 30-40 minutes.

Hypochlorite stage

The hypochlorite stage can and is carried out at either low or high consistency. It is our experience that a high consistency stage will produce cleaner pulp of a little less strength than a low consistency stage. At either

*Neutral sulfate semichemical pulp.

**Research Director, West Virginia Pulp & Paper Co., Luke, Md.

Table III
Strength of NSSC Birch Pulp

	Unbleached	Bleached Single Stage Hypochlorite
Williams freeness	75	75
Tear	63	66
Burst	44	46
Fold	150	200
Tensile	78	74
Bulk	1.43	1.35
Gurley porosity	78	340
Str. No.	18.2	19.4

Table Va
Comparison of High and Low Consistency Bleaching of NSSC Unbleached Pulp from C. Poplar

Stages	Low Consistency	High Consistency
1. Chlorination		
Consistency	2.5	2.5
Temperature	room	room
Chlorine, % on pulp	11.0	11.0
Time to consume	5 minutes	5 minutes
2. Alkali Extraction		
Consistency	2.5	10%
Temperature, °C.	48-52	46-52
NaOH on pulp	3%	2%
pH	11.1-11.6	7.7-8.2
Time	1 hour	1 hour
3. Hypochlorite		
Consistency	2.5	10%
Temperature, °C.	34-38	38
Chlorine (lime bleach)	1.8	1.8
Time	5 hours	5 hours
Chlorine consumed	1.40	1.64
pH	9.2-10.4	8.4-11.5

low or high consistency, it is extremely important to buffer with NaOH to a pH of 9-10 so as to avoid degradation of the pulp in strength and viscosity.

In tables IVa and IVb there are data as to chlorine and NaOH consumption based on unbleached pulp; and yield and brightness of bleached pulp produced from four hardwood NSSC pulps by a three-stage bleaching sequence.

In tables Va, Vb and Vc there are listed bleaching conditions for a three-stage sequence operated at either low or high consistency and the resulting chemical and strength properties of the two pulps.

In table VI there are listed data that show the comparative chlorine consumption, yield and strength values of bleached NSSC and sulfate pulps from the same woods.

Bleached NSSC pulp has properties which make it an excellent substitute for acid sulfite spruce pulp in quality as well as in cost. The pulp as delivered to the paper mill has a Williams freeness of approximately 50 seconds and therefore requires little additional refining. The pulp can be

Table IVa

Wood Used	Unbleached Pulp: O.D. Yield	Unbleached Pulp: % Lignin	Unbleached Pulp: Brightness	First Stage: % Cl_2 on Pulp	Second Stage: % NaOH	Second Stage: K No.	Third Stage: % Cl_2 as Hypo	Bleached Pulp: O.D. Yield	Bleached Pulp: Brightness
Gum	65.1	10.0	30	14.0	4.0	4.6	1.9	53.1	81.1
C. Oak	63.2	7.5	28	12.3	4.0	3.6	1.8	54.7	84.8
Hickory	65.5	8.7	43	14.5	4.0	2.7	1.4	54.8	86.5
H. Maple	68.2	7.6	48	13.9	4.0	2.5	1.5	57.3	88.8

Table IVb
Strength of Bleached Pulps at 75 Seconds Williams Freeness

Wood	Minutes to beat	Tear	Burst	Fold	Tensile	Bulk	Str. No.
Gum	6.5	93	58	310	80	1.33	23.8
C. Oak	9.0	88	43	190	66	1.46	19.1
Hickory	11.0	106	66	380	84	1.46	26.2
H. Maple	9.5	64	58	290	79	1.27	20.9

Table Vb
Chemical Values

	Unbleached	Low Consistency: After Chlorination and Caustic Extraction	Low Consistency: After Hypo	High Consistency: After Chlorination and Caustic Extraction	High Consistency: After Hypo
K No.	—	7.3	—	3.2	—
Brightness	46.1	56.6	74.8	59.2	86.0
Pentosans	21.8	—	22.8	—	21.5
Soluble in 3% NaOH at 100°C.	11.7	—	14.4	—	16.0
Alpha cellulose	—	—	76.9	—	76.4
Williams freeness	34	152	90	96	71
% Yield — Unbles. Pulp Basis	—	—	86.3	—	83.4

Table Vc
Strength Values

	Unbleached		Bleached Low Density		Bleached High Density	
Beating time	0	10	0	10	0	10
Williams freeness	34	80	90	179	71	149
Tear	76	67	75	66	72	61
Burst	35	51	63	73	61	69
Fold	40	100	450	1390	330	1350
Bulk	1.40	1.28	1.21	1.11	1.20	1.11
Gurley porosity, sec.	15	244	246	1800	100	1390
Str. No.	16.2	19.0	23.2	24.7	22.3	23.6

Table VI
Comparison of Strength of Bleached Pulp from the Same Woods by the NSSC and Sulfate Processes

Wood	Process	% Cl_2 Applied	Brightness	O.D. Yield per Cord	Time to Beat	Strength Values at 75 seconds Williams: Tear	Burst	Fold	Tensile	Bulk	S.N.
Gum	Sulfate	4.34	78	1192	22.5	109	47	130	61	1.47	22.1
	NSSC	16.0	81	1295	6.5	93	58	310	80	1.33	23.8
C. Oak	Sulfate	3.27	80	1623	28.0	91	32	50	51	1.49	16.3
	NSSC	14.3	85	1863	9.0	88	43	190	66	1.46	19.6
Hickory	Sulfate	3.71	81	1797	30.0	116	45	130	68	1.52	22.4
	NSSC	16.5	86	2050	11.0	106	66	380	84	1.46	26.2
H. Maple	Sulfate	3.02	84	1623	33.5	68	35	30	54	1.40	15.2
	NSSC	15.9	89	1845	9.5	64	58	290	79	1.27	20.9

used as a 100 per cent component of the furnish, but usually it is blended with sulfite or sulfate pulp in the production of the hard types of paper such as bond, tablet, envelope, poster and offset. It is too transparent and dense for use in either uncoated or coated publication paper, except when groundwood is a large component of the furnish. It can be used as a 100 per cent component of the furnish in producing greaseproof and glassine grades of paper.

In regard to the economics of the manufacture of NSSC hardwood pulp, it is best to have the plant associated with a kraft mill so that the chemical in the waste liquor can be used as make-up chemical for the kraft mill. Although NSSC pulp can be bleached to 85-90 per cent brightness in a three-stage sequence, the consumption of chlorine and caustic soda and the loss of yield during bleaching are very high so that in comparison to kraft hardwood pulp it is more costly, even with the greatest yield of fiber per cord of wood.

Bleaching of groundwood pulps

ANTHONY A. YANKOWSKI*

GROUNDWOOD IS A HIGH YIELD and low cost pulp, and in papers such as news the unbleached brightness in most cases is sufficient. In the manufacture of higher grades of papers, the lack of brightness and the tendency to discolor has limited the use of groundwood. Bleaching has increased the use of groundwood in these papers. In book papers where a portion of the furnish has been groundwood, bleaching has increased the final brightness of the paper and allowed an increase of the amount used. The brightness of the groundwood has a greater effect on the final paper brightness than the chemical pulp brightness. In book papers, 3 points of groundwood brightness will increase the paper brightness one point, whereas it takes 6 points of chemical pulp brightness to increase the paper brightness one point. And, of course, in newsprint, a one point change in groundwood brightness will increase the news brightness almost a full point.

Peroxide bleaching

The bleaching liquor can be made up in several ways. The alkalinity calculated as NaOH is quite important. The bleach liquor is made up of hydrogen peroxide and caustic, sodium peroxide and sulfuric acid or sodium peroxide and hydrogen peroxide. Most mills are using the mixed peroxides. In addition, sodium silicate and magnesium sulfate are added. The silicate acts as a buffer and has a stabilizing effect on the peroxide solution. It also forms a protective coating on the surface of metals and inhibits corrosion. Small amounts of magnesium sulfate inhibit the catalytic effect of traces of metals such as copper, manganese, and iron.

Common formulas for 2 per cent sodium peroxide are:

	%	%	%
Epsom Salt	0.05	0.05	0.05
Sodium Silicate	5.0	5.0	5.0
Solozone (Na_2O_2)	—	2.0	1.0
Sulfuric Acid	—	1.4	—
Caustic Soda	1.0	—	—
Albone (H_2O_2)	1.68	—	.84

The solution can be made up either continuously or batch. The order of chemical addition to make up the solution is water, epsom salt, sodium silicate, solozone and albone. This order is quite important as the addition of the silicate before the epsom salt will cause a floc to form.

The silicate as has been mentioned coats out and especially in the bleach liquor line. This can be overcome by using a rubber hose for this line, and when the line begins to fill up, flexing the rubber hose breaks the silicate loose.

Peroxide bleaching can be done either continuously or batch. A typical flow in a peroxide bleachery is as follows: The thickened stock is mixed with the bleach liquor in a mixer and pumped or dropped into a retention tank. From the retention tank, the stock is pumped to a neutralizing chest where SO_2 is added. The stock is then pumped to a supply chest.

At low (4-5%) consistency, the stock is used as it comes from the decker. At medium (10-15%) and high (30%) consistencies, additional thickening after the deckers is required. Steam is generally introduced ahead of the mixer to get the required temperature. The liquor flow is controlled by the flow of stock, which is usually metered after the deckers prior to additional thickening equipment. The size of the retention tanks or tower is dependent on the bleaching time required, which is established by the consistency and temperature. The neutralizing chest is small and well agitated. There should be an excess of peroxide in the stock going to the neutralizing chest, otherwise the stock will revert in brightness. SO_2 is added for reducing and neutralizing, and this action is almost instantaneous. The flow of SO_2 can be controlled by a pH controller. Usually the pH is controlled to 7 and further reduction, if necessary, is accomplished by the addition of alum.

The controllable variables that affect the process are: consistency, temperature, peroxide concentration, total alkalinity of the liquor, and pH.

Consistency affects the time of bleaching and the final bleached brightness. As the consistency is increased, the bleaching time is reduced and the brightness gain is increased.

Temperature has an affect on bleaching time. As the temperature is increased, the bleaching time is decreased.

The concentration of peroxide used affects the final brightness. As the per cent of peroxide is increased, the brightness is increased. It takes more peroxide per point gain in brightness as you go to higher brightness.

The total alkalinity of the liquor calculated as NaOH based on the bone dry weight of pulp should be 1.2-1.9 per cent. The optimum alkalinity for any pulp at any set of conditions must be first determined in the laboratory. At low consistencies and low temperatures a high alkalinity is desirable. At high consistencies and high temperatures, a low alkalinity is desired. The pH of the stock after the addition of the bleach liquor should be between 10 and 10.5 to obtain the optimum brightness gain.

In many cases it has been found that the pretreatment of the stock with 1-2 per cent calcium chloride will raise the brightness 1 to 2 points.

Calcium hypochlorite bleaching

The bleachery flow is as follows. Deckered stock at 5 to 6 per cent and a temperature of 38°C is pumped to a reaction tank with an agitator. A batch generally consists of about a ton and a half of bone dry stock. Bleach liquor is added to the stock in the reaction tank. Part of the caustic necessary is added with the bleach liquor and the remainder of the caustic is added throughout the bleaching cycle to maintain a pH of 9-11. After the exhaustion of the chlorine (about 20-25 minutes) the stock is pumped to a washer. After being washed, the pulp is acidified to a pH 5-5.5 and cannot be washed, or not as required in the paper process.

The controllable variables in the process are: consistency, temperature, pH, and chlorine concentration.

Temperature affects the rate of the reaction and the final brightness. As the temperature is increased, the rate of the reaction increases very rapidly and is very hard to control. The brightness also increases as the temperature is increased. The optimum temperature is 38°C.

The brightness increase at 43°C probably should be higher but because the reaction goes so rapidly, it is very hard to control and would cause this lower brightness increase.

Consistency does not seem to affect the final brightness. As the consistency is increased, the rate of reaction increases. However, at consistencies

*Pulp and Wood Preparation Department, Research and Development Div., Kimberly-Clark Corp., Neenah, Wis.

over 10 per cent the rate of reaction is so rapid it is very hard to control.

Best results are obtained in a fairly narrow range, the same as with peroxide bleaching. At a pH of 9.5 to 10.5 the reaction is readily controllable and the variation of pH within this range is not critical. At pH 9, best results are obtained in the shortest period of time; however, if the pH falls below 9 the pulp discolors and additional chlorine is needed to bring up the brightness. If the pH rises above 11, the pulp also discolors and additional chlorine is necessary.

The chlorine concentration affects the final brightness. Up to 15 per cent chlorine the gain in brightness is fairly steady. Higher percentages of chlorine do not raise the brightness an equivalent amount.

The acidification of the stock following the bleaching reaction prevents reversion. Washing prior to acidification reduces the amount needed to acidify and also reduces the dissolved solids in the pulp. It is best to acidify to a pH of 5-5.5 using SO_2, as there is an additional gain of 2 points of brightness that can be realized.

Zinc hydrosulfite

The bleachery flow is as follows: Groundwood after the deckers is mixed with the zinc hydrosulfite solution in a mixer and then sent to a retention tank. After the necessary reaction time, it is sent to the supply chest for the paper mill. Zinc hydrosulfite can also be used at the grinders where higher temperatures are obtained. However, best results are obtained if the stock and zinc hydrosulfite are well mixed and allowed to stand in a retention tank.

The controllable variables that affect the process are consistency, temperature, pH and concentration of chemicals.

Best results are obtained at consistencies of 1-6 per cent since good mixing of the hydrosulfite and pulp is essential. At higher consistencies it is harder to obtain good mixing, and the air mixed with the stock decomposes the hydrosulfite.

The best operating range of pH is 5.0-6.5. At higher pH there may be a yellowing of the stock, and a pH below 4.5 will promote the decomposition of the hydrosulfite.

With each increase of 20°F of the bleaching temperature, the final brightness increases about 1 point. Temperature also affects the bleaching time. 90 per cent of the brightness is obtained in 15 minutes at 165°F and the bleaching is completed in 1 hour. At a temperature of 90°F, 90 per cent of the brightness is obtained in an hour, and takes 3-4 hours to complete the reaction.

As the per cent of zinc hydrosulfite is increased to 1 per cent, substantial brightness gains are made. Above 1 per cent only a small amount of brightness gain is obtained.

Pretreatment of the pulp with ½ per cent sodium tripolyphosphate in many cases will give 1-2 points of additional brightness. The sodium tripolyphosphate is added to the pulp just prior to the addition of the zinc hydrosulfite. Some work in the laboratory and on a mill scale has been done using zinc hydrosulfite after the pulp has been bleached with peroxide. Gains of 4-5 points of additional brightness have been obtained.

Effect of wood species

Hypochlorite is most effective on hardwoods such as poplar. In fact, there are some woods which can be bleached satisfactorily with hypochlorite but not with peroxide. Spruce, on the other hand, responds much better to peroxide bleaching. The dirt count, especially that from rot, is reduced more using hypochlorite than peroxide. Zinc hydrosulfite bleaches most woods, but the final brightness that can be obtained is lower than that which can be obtained with peroxide or hypochlorite.

The chemical cost per point of brightness gain per ton of pulp is approximately:

$0.50 for zinc hydrosulfite

$0.70 to $1.00 for peroxide depending on wood species

$0.80 for hypochorite on hardwoods

The yield loss is higher when using hypochlorite than when bleaching with peroxide or zinc hydrosulfite. The loss in yield with peroxide or zinc hydrosulfite is less than 1 per cent; with hypochlorite it is as much as 2.5 per cent.

Peroxide Bleaching of Southern Pulps

(continued from page 997)

2 per cent would be suffered on sulfite pulp.

Washing between the two stages is optional, and most of the pilot and development work has been done without washing. In effect, the thickening accomplished between the stages removes some of the products of oxidation in the first stage, and it is recommended that this white water be sewered or at least not used within this two-stage bleach system. A wash between stages would be recommended when the Hooker chlorination-hypochlorite sequence is employed.

The second stage (hydrogen peroxide) can be carried out at any density, although greatest economy is found at higher densities. Comparative chemical economy with the same brightness level would indicate 20 per cent saving in using 12-15 per cent density as against 3-5 per cent density, and another approximate 20 per cent gain is shown raising density to 25 per cent. Retention time of 2-3 hours will be required at moderate density as compared to 1-2 hours at high density. Temperature ranges will depend somewhat on pulp, but ordinarily are in the range between 140-160°F.

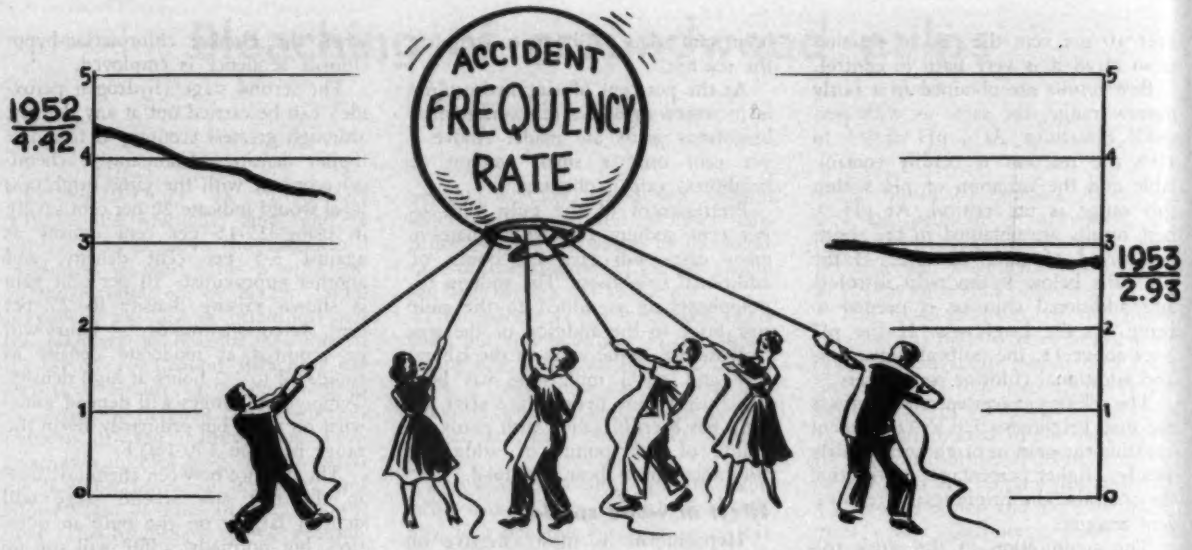
The balance between chemicals used in the first and second stage will depend largely on the pulp in question, but normally sulfite will use up to about 5 per cent av. Cl_2 in the first stage with sufficient peroxide to reach the brightness level desired in the second stage. For semichemical pulps, or pulps containing high lignin and hemicellulose fractions, the chlorine in the first stage may be raised to 10-12 per cent followed by sufficient peroxide in the second stage to reach the level desired or be economically feasible.

Greatest value of this system is in the saving of yield, a point of considerable interest to pulp producers and papermakers. Normally, this system would give a yield 3-7 per cent higher than a corresponding chlorination-hypochlorite two-stage system, and an additional gain of about 2 per cent over a three-stage chlorination—extraction—hypochlorite system. This process is not one to produce brightness in the 80-85 level on all pulps, although such is the case with sulfite. Normally, hardwood semichemical pulps could be brought up to the 75 brightness level which is, in many cases, suitable for use in papers produced from such grades. Table I shows some of the results which have been obtained on southern pine kraft pulp using the last-stage peroxide tower treatment. Results include both laboratory and pilot operation.

Results on the Becco Pulp Dryer System on several southern pine kraft pulps may be seen in Table II. Of special interest is the comparative brightness between control pulps and hydrogen peroxide-processed pulps after bale storage periods of from two to four weeks.

Results on the two-stage hypochlorite-hydrogen peroxide sequence may be seen in Table III.

Table IV presents some aging data on pulp treated by the three processes discussed in this paper.



An industrial accident investigation technique

Part I

K. H. TUCHSCHERER
Staff Safety Supervisor
Kimberly-Clark Corp.
Neenah, Wis.

▶ At the National Safety Congress in Chicago in October, Kimberly-Clark Corp. was awarded the Arthur Hoyt Scott Trophy. The presentation is made each year to that firm whose operations in all its plants combined result in an outstanding safety record.

▶ During 1953, Kimberly-Clark worked a total of 15,679,785 manhours in seven company units for a frequency rate of 2.93, down almost 34 per cent from its 1952 rate.

▶ In this the first part of a two part article Mr. Tuchscherer discusses such vital phases of accident investigation as: its function and essential elements, proper reporting techniques, causes and effects, and management's role

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"1. *Only those who have a 'safety conscience' and a real desire to work in the safe way, obey safety instructions and avoid unsafe practices, are acceptable as employees of this company.*" — *This is paragraph* 1 *in the "Safety Code for Employees" printed and distributed to employees in January* 1926 *by the Board of Directors of the Kimberly-Clark Company, two years before incorporation. Some years earlier Kimberly-Clark had pioneered in the field of industrial safety.*

CONSTANT EFFORT, management insistence on safety and the cooperation and enthusiasm of all employees has made Kimberly-Clark Corp. a safe place to work. The combined frequency rate for all production units in 1953 was 2.93. The average frequency for the last five years has been approximately 3.44.

It is our feeling that successful safety experience is based on the recognition that industrial safety is a management responsibility and that to be effective any safety program must have the unlimited enthusiasm, cooperation and participation of all employees.

By definition, accident investigation is a procedure to determine and identify—either before or after an accident—existing hazardous conditions, practices and procedures so that future accidents from the same or similar combinations of circumstances can be prevented. Put another way, accident investigation may be compared to the advice usually given by an old straw boss to a young man on his first day at work: "Young man, nobody's perfect, and everybody makes a few mistakes. The way to get along in this plant and to keep your job is to be sure that you don't make the same mistake twice."

It is not the purpose of this article to consider the classification of accidents, nor to review or expand upon the statistical approach to the matter of industrial injuries. Instead, it will be concerned with two subjects: what happens in the case of an industrial injury and the companion problem of what can be done to avoid a repetition.

Seven basic functions

We have found that accident investigations both of the corrective and preventive type serve several useful purposes. Investigations perform the following functions:

1. Provide recognition of hazards—equipment, tools, operations and practices which are of an unsafe nature.
2. Indicate where process and procedure changes must be made to protect personnel.
3. Assist in training employees in the right and safe method, with an appreciation and awareness of hazards.
4. Serve as a tool for supervisors, so that they can talk safety and personalize the subject by bringing it home in a local environment, thereby giving it real color and a definite meaning.
5. Clarify job requirements in terms of

the type of worker, age, skill, physical characteristics, etc.
6. Eliminate recurrence of the same type and nature of industrial injury.
7. Provide an opportunity for sincere and honest management to take intelligent effective action to correct hazardous conditions and operating procedures.

Kimberly-Clark's experience in its several mills indicates that there is no magic formula, master plan, nor standardized routine for accomplishing a good accident investigation. Good investigations as distinguished from run-of-the-mill inquiries require the presence of a number of characteristics. Here are some of the elements we feel are essential to a complete investigation:

1. A usable, intelligent and simple accident investigation form.
2. A complete inquiry, which includes all phases and contributory causes of the accident.
3. An unbiased and honest search for facts.
4. Absence of intent on the part of those investigating the accident to blame or to personally criticize any employee.
5. A well-rounded, competent investigating committee.
6. The cooperation of the injured employee and other employees on the same job.
7. Practical and realistic recommendations for improvement.
8. Distribution of the accident investigation report to the right people.
9. Careful follow-up and enforcement of the recommendations made.

Accident investigation form

The accident investigation form is usually a matter of local preference. When preparing or revising a form it might be well to consider the natural tendency of supervisors and others to usually do a rather incomplete job when filling out a form as such. Experience seems to indicate that a request which requires a written answer in more than a word or two describing the situation is usually preferable and results in better information and a more complete story.

The form ought to contain the questions usually asked by most supervisors and plant managers. The questions follow about this pattern.

1. What happened?
2. Who is hurt and how badly?
3. What caused the accident?
4. What was wrong?
5. What can we do to fix it to avoid another incident?
6. How can we be sure it doesn't happen again?

If these data together with the injured employee's name and the

date of the accident are included it is highly probable that the questions will give adequate information and be the nucleus around which a good investigation can be conducted.

Our preference for a written description can perhaps best be shown by the nature of two investigations of different accidents, both of which involved the same elements and approximately the same set of circumstances. Under the subject heading of "Nature of the Accident," in one situation the supervisor wrote "slipped on floor and fell." In his opinion this was adequate to describe the nature of the incident.

Worth doing well

In the second case this is what the investigator had to say:

"Joe was taking care of a portion of his reguar cleanup job in the basement, which included cleaning out the air washer and the floor adjacent to it. He had taken all the water hose off the spindle and let it lay on the floor in a coiled position, washing the area immediately around the washer. He then proceeded to squirt the floor farther away from the washer, and while attempting to pull the hose from this coiled position he slipped and fell on his hip, causing the injury. On investigation we find that the floor had been squirted down around the oil tanks, which are located near the washer. While there was no evidence of oil on the floor, it was the opinion of those who checked the area that the floor is oil-soaked, and when water is on it this area becomes a very slippery surface."

There is little question but what the second type of description supplies the supervisor and the plant management with a considerably better picture of the type of injury and the facts and circumstances surrounding the accident.

With apologies to Lord Byron for the adaptation of his famous statement, it is our feeling that accident investigations must be complete because, "If it's worth doing it's worth doing well." Like so many other things in running a business, half a story or incomplete factual information is worse than none at all. This is particularly true in accident investigation cases. Obviously, neither corrective nor preventive action can be taken if the basis on which such action is founded is an incomplete or erroneous set of facts. Completeness is even more essential for the reason that accidents not at first recognized as being of a lost-time nature very frequently do involve lost time at a later date. Should an accident become a "lost-timer" and compensable, obviously all of the facts must be known. After several weeks or even months memories become dim, and it is then very difficult to get a complete story.

All causes recognized

It has been our experience that rarely has one particular situation or circumstance been the exclusive cause of an injury. In fact, in most cases it is quite obvious that a series or a number of items contribute to the accident; that if any one of two of the contributing reasons had been absent the accident might not have occurred. This merely indicates that all causes must be considered, and that while not all may be equally important, it is most essential that each one be recognized and properly evaluated. Certainly, for a complete investigation the scene of the accident must be visited, and all of the employees who may have witnessed the incident must be asked their version of what happened. Assumptions may never be made inasmuch as guesses are a poor substitute for the fact. Ambiguity, vagueness and the attitude "that's good enough" have no place in accident investigation.

Statistics show that relatively few accidents are attributed to equipment failure alone. In most cases employee action is the primary rea-

son or significant contributory cause of the accident. Investigations must of necessity deal with people, and it is necessary to review their actions that were part of the accident. When men review what other men have done, particularly when there is a tendency or necessity to criticize, human attributes are bound to be in evidence. Our experience with the foreman or department supervisor as a committee of one to investigate accidents has not been satisfactory, although certainly our foremen and supervisors have the honesty and integrity characteristic of all men in this group. It is our feeling that the committee approach to the matter of accident investigation is to be preferred. In so doing we eliminate the probability and temptation to pass the buck or to develop excuses which the occasional less-principled supervisor may be prone to do if he alone has the responsibility for investigation.

Just as completeness and thoroughness is necessary, so too is an honest and unbiased report essential. By using the committee approach and the injured employee as part of the investigation, we feel that we can eliminate the possibility for bias or personal prejudice.

A management responsibility

While we believe that "Safety is Everybody's Business," Kimberly-Clark recognizes that safety is a management responsibility. As such, accidents can only be attributed to those who are responsible. Blame or criticism of the injured employee is simply an attempt to shun responsibility and failure to carry the load.

Blaming the injured employee carries with it certain dangers which may immediately or eventually seriously hamper the safety effort in any plant. Following the American way of reacting, it is only natural for fellow employees to rally to the defense of the less fortunate. It is also quite evident that blame or reflection upon the injured only adds to an already uncomfortable situation. In most cases the natural shame, disappointment and lack of prestige which associate themselves with an accident are enough to make the injured feel quite badly and in need of sympathy rather than further criticism.

Naturally of course, it is the responsibility of management to point out in a clear and factual manner the better and safer way to make constructive suggestions. Except in performing these management functions, personal fault finding has no place in accident investigation.

Konrad H. Tuchscherer (r) receives the Arthur Hoyt Scott Trophy in behalf of Kimberly-Clark Corp. Making the award is C. L. Lyon of Scott Paper Co.

Perhaps another reason for purposely avoiding any reflection upon the injured person is its effect on fellow workers upon their return to work. It has been our experience that in departments which have had a particularly long run of accident-free operation fellow employees "take care of" the matter of correction as well as appreciate the seriousness of an accident in their informal contacts with the injured employee.

500 miles from home

One "trick" that frequently works toward the elimination of the blame in any investigation is to have the investigating group think as if the investigation were being made at some other plant, and that the services performed were being done for that plant with a very impersonal approach to the entire problem. We are sure that any accident investigating committee, transplanted 500 miles from home into another plant one in which they knew the process but not the people—could do an excellent job and would not run the risk of personal bias, prejudice or an attempt to blame the injured employee.

Before leaving this subject it may be appropriate to give a word of caution about the opposite temptation in any investigation which involves the supervisor's or the committee's own department. On occasion there is a tendency to do a "whitewash" or "cover-up" job. These are worse than nothing. The "whitewash" is the greatest sin against plant safety, and while it reflects adversely upon the committee, more importantly it gives a false security to the entire plant supervision and completely fails in its basic purpose.

Enthusiasm and interest

There is no "best" setup for an accident investigation committee. It is obvious, however, that the caliber of its performance is in direct proportion to the enthusiasm and the real interest of the people performing the job.

Our practices as to committee size vary among our plants, but a group composed of the injured man, the foreman, the department superintendent, the plant safety man and two department safety committee representative gives about the right balance.

It is our feeling that the people in the department, such as the injured employee, other employees on the same job, the immediate supervisor, and others close to the process, are most familiar with the equipment, practices, and procedures in that particular operation. These men can make a major contribution, and it is our experience in almost all cases that the so-called "outside experts" are not necessary to get a complete story. This group is remarkably capable of making recommendations, particularly from a practical angle, as to what could or should be done to correct the situation.

Accident investigations must be conducted as soon after the accident as possible. Our practice and guide in this particular matter is, "do it now." In addition to the problem of a fuzzy recollection of what took place, other problems involved in a delay include such things as a lack of enthusiasm for the investigation or recommendations for correction. It is essential that a preliminary investigation be made early, particularly in the serious cases where there is evidence that the situation might happen again.

Two or three of our mill safety men have developed a successful procedure by conducting a so-called preliminary investigation without the attendance of the injured employee. In such cases, a small group is asked to look over the scene of the accident, determine the cause together with the surrounding circumstances and make preliminary recommendations which can be accomplished before the full and final investigation is made.

In this same situation another "trick" that works quite well is to have the safety man issue a preliminary report of the accident for the mill supervisors and for publication on the bulletin boards, particularly when the accident is serious. We find that after a serious injury rumors are prone to float through the mill, and without a correct set of the facts the story which gets to many of the employees is distorted. A short description indicating what happened, perhaps how it happened and the injured employee's condition is adequate to stop false rumors and fears that have a tendency to disturb plant morale.

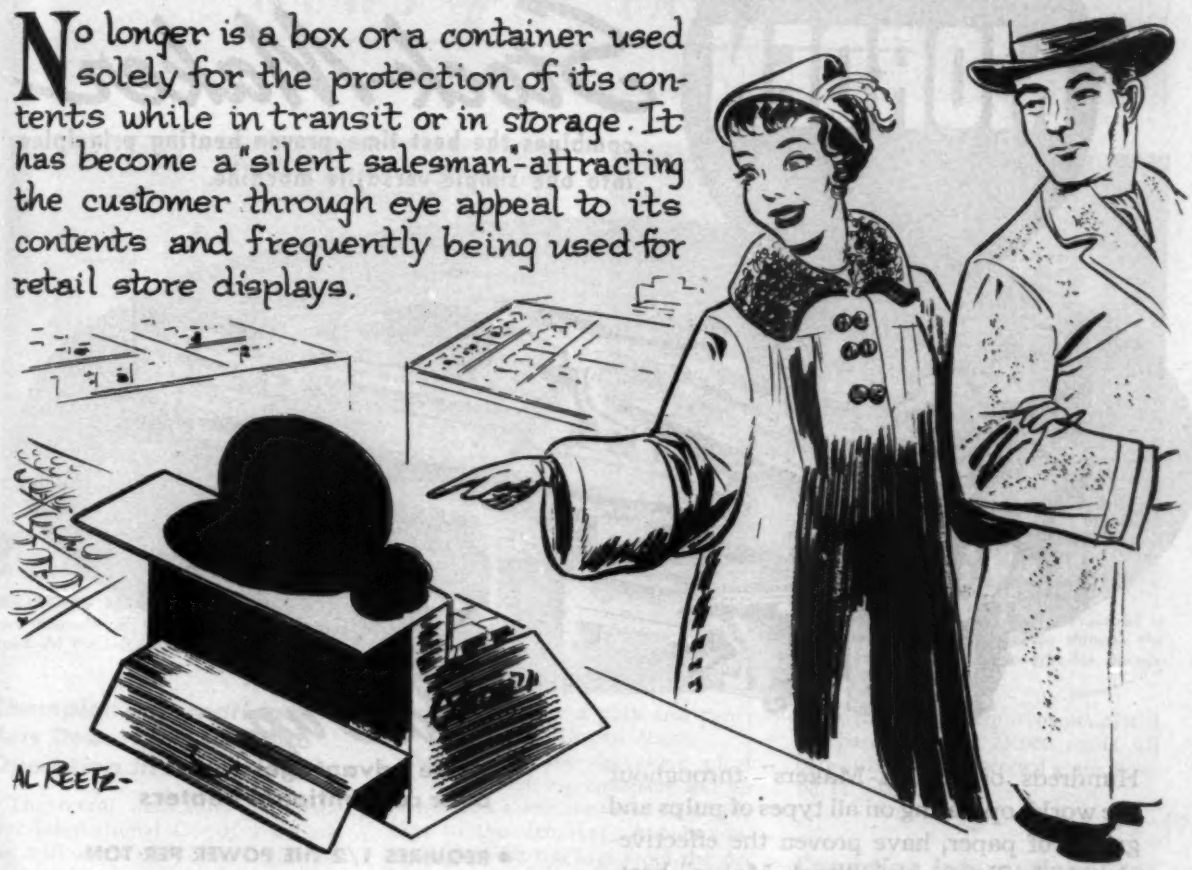
COLOR PHOTOGRAPH BY JOHN G. HOLYOKE

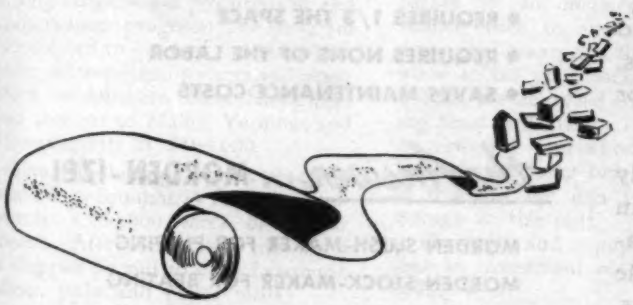
BELOIT IRON WORKS · PAPER MACHINERY · BELOIT, WIS., U.S.A.

Two New 252" Beloit Machines at Bowaters Southern Paper Corporation, Calhoun, Tenn., are producing high-quality newsprint. Machines include Beloit Air-cushioned Inlet, Suction Pick-up, Suction Wringer Roll for the pick-up felt, Air Guides for both wire and felts, Open-side Calender, and a clean-cutting "Model L" Winder with shaft-pulling equipment.

PAPER SKETCHES

No longer is a box or a container used solely for the protection of its contents while in transit or in storage. It has become a "silent salesman"-attracting the customer through eye appeal to its contents and frequently being used for retail store displays.





In recent years there has been a tremendously increased output of bleached board and paper for use in making milk bottles, drinking cups, frozen food cartons, etc.

The customer is continuously calling for more and more **BLEACHED PAPER** products. Heeding this call, and finding new uses for bleached paper products, the pulp and paper industry will put its eggs in increasingly more baskets as time goes on.

MORDEN *Stock-Maker*

combines the best time-proven beating principles into one simple versatile machine.

Hundreds of "Stock-Makers" throughout the world, operating on all types of pulps and grades of paper, have proven the effectiveness and efficiency of "Stock-Maker" beating—from light brushing for soft tissue, to medium treatment for writings, wrappings, etc., on up through extreme hydration for greaseproof and carbon.

"Stock-Makers" can be used advantageously for continuous, single-pass, closed-system beating, direct to the paper or board machine. They can be readily adjusted to handle many variations in treatment requirements.

Add up

these advantages over conventional beaters

- **REQUIRES 1/2 THE POWER PER TON**
- **REQUIRES 1/3 THE SPACE**
- **REQUIRES NONE OF THE LABOR**
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the Answer... MORDEN-IZE!

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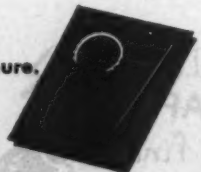
MORDEN STOCK-MAKER FOR BEATING
MORDEN STUFF-MAKER FOR JORDANING

GET ALL THE FACTS!
Send for "Stock-Maker" brochure.



Northeastern States Representatives:
ORTON CORPORATION, Fitchburg, Massachusetts

Midwestern States Representatives:
DAN B. CHAPMAN, Appleton, Wisconsin

Other Representatives in most paper-making countries.

MORDEN
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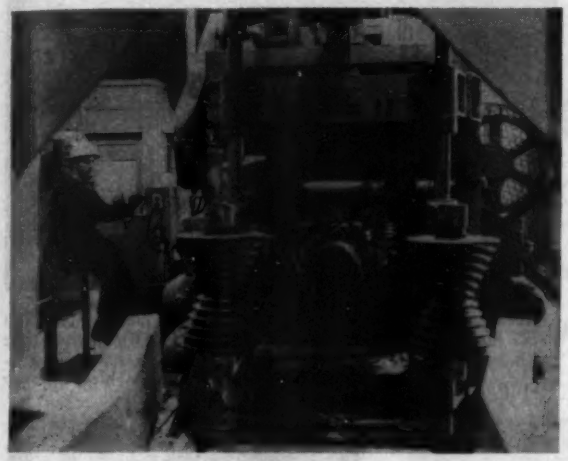
NEWS of the INDUSTRY



DEBARKING MILL recently dedicated at Bow, N. H., by Champion-International Co. is in full operation processing local pulpwood. At the left is the Andersson debarker, which uses pneumatic tools to remove bark without wood loss; the unit was developed in Sweden. At the right, debarked pulpwood logs pass through the fixed saw slasher, where logs are cut into 4-ft. lengths for storage

Champion-International Puts Debarking Mill into Operation in Bow, N.H.

The recent dedication by Champion-International Co. of a debarking mill at Bow, N. H., highlights a long-range wood procurement and conservation program. The program is expected to increase the annual income of woodland owners and operators in southern New Hampshire and sections of Maine, Vermont and Massachusetts by $500,000.

The debarking mill processes pulpwood logs brought in from approximately 1,250,000 acres of nearby forests. After seasoning, the wood is shipped by rail to C-I's Lawrence, Mass., pulp and paper mills.

The recently instituted program will make extensive use of the hardwoods abundant in this region—birch, beech, maple and oak, which technological advances in papermaking have made usable for high-grade paper manufacture.

Andersson Debarker

The chief feature of the Bow mill is the Andersson debarker, a Swedish machine widely used in Europe. It employs air-activated tools to remove the bark without wood loss.

According to Champion-International, the Andersson installation is the first made by a pulp and paper company in the United States.

Included in the debarking plant are a powered log crosshaul and air kicker and a roll conveyor to supply logs to the debarker. A belt conveyor delivers the logs from the debarker to an inclined fixed saw slasher, then to another belt conveyor that transports the 4-ft. pulpwood to the yard stacker.

Logs are delivered to the debarking plant in 8-, 12- or 16-ft. lengths. A powerful four-wheel drive and four-wheel steering fork truck is used to transport the logs from original storage to the mill.

The mill and equipment represent an investment of about $250,000.

25,000 Annual Cords

C-I's Woodlands Div. began operations in New Hampshire and surrounding regions on the hand-peeled pulpwood in the conventional 4-ft. lengths. Seasonal labor requirements indicated the eventual need for mechanical barking equipment, and investigations of such equipment were undertaken. In 1952, procurement was shifted to log-length hardwood that better fitted the traditional local logging methods, and trial operation of a log debarker of Swedish manufacture was initiated. At the present time, the annual requirements of C-I for hardwood are 25,000 cords, all of which will be processed at the Bow, N. H. plant.

•

Canadian International to Install "Largest Machine" in $15,000,000 Program

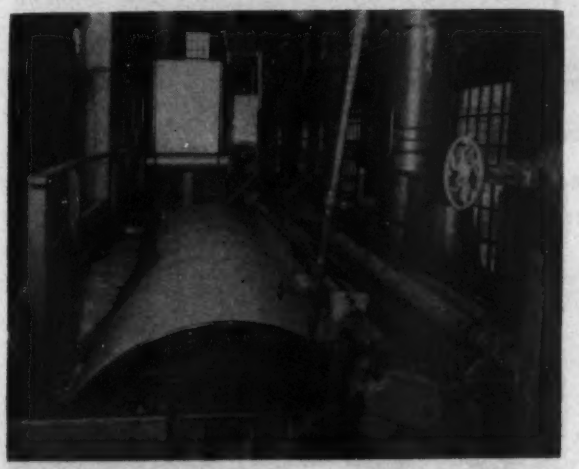
The installation of a 276-in. fourdrinier machine for the manufacture of kraft liner board for corrugated shipping containers has been announced by Canadian International Paper Co. at its La Tuque, Que. sulfate mill. The project will be part of a $15,000,000 expansion program announced by Vernon E. Johnson, president.

Mr. Johnson declared that the machine will "be the largest board machine in the world."

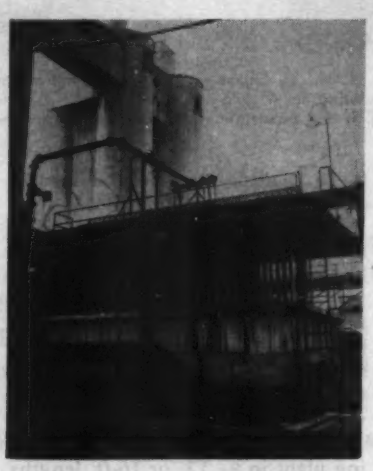
The building program at La Tuque will include the expansion of the present pulp mill, increased wood handling and storage facilities, increased capacity for the chemical recovery system, the installation of a new steam boiler to produce 200,000 lb. of steam per hour, and the addition of new digesters to provide a substantial increase in the pulp-producing capacity.

The company acquired the pulp mill, which has an annual capacity of

Scott Expansion on West Coast Assumes Major Proportions



DURING 1954 the expansion program at Scott Paper Co.'s Everett, Wash., plant assumed major proportions. The over-all project was concentrated in two areas—continued paper mill construction and the addition of facilities in the pulp mill, already the largest bleached sulfite plant in the world. The firm's second high-speed paper machine went on the line in 1954, with two more scheduled for installation in 1955. At the left above is the new Impco valveless decker, while at the right is the new Impco bleach washer



PULP PRODUCTION at the new Scott plant has been increased to more than 700 daily tons of high-quality bleached sulfite. Another change: the use of ammonia instead of calcium in the preparation of the cooking solution. New equipment shown here includes (l) control panel of 10-ft. Bellingham barker; (center) Jenssen cooling system used in making the ammonia cooking solution, and (r) heat exchangers installed in connection with the ammonia system

165,000 tons of high-grade bleached pulp, together with 2,500,000 acres of woodlands, from Brown Corp. in a transaction completed December 1.

•

Beckett to Install Machine in $1,000,000 Program

Beckett Paper Co. of Hamilton, Ohio, has completed plans for the purchase of a fourdrinier machine in a $1,000,000 expansion program.

The unit will trim from 126 to 130 in. and will be rated to produce in excess of 60 daily tons of fine printing papers at speeds up to 600 fpm. Operation is expected during the summer of 1956.

Rhinelander and W. T. Co. Form New Company

Rhinelander Paper Co. and Weyerhaeuser Timber Co. have jointly announced the organization of the R-W Paper Co.

R-W will immediately start construction of a paper mill at Longview, Wash., for the manufacture of glassine and greaseproof papers. On completion of the mill in 1956, the company will offer improved service to customers in the Pacific Coast area. R-W will obtain its supply of wood pulp from the Weyerhaeuser mills in the region.

Officers of the new company will include Folke Becker of Rhinelander Paper in Rhinelander, Wis., president; W. P. Gullander of Tacoma, Wash., vice president and treasurer; George S. Long Jr. of Tacoma, secretary, and Miss Ruth Neuman of Rhinelander, assistant secretary.

Directors are Mr. Becker, B. R. Cancell and R. F. Nelson, all of Rhinelander, and J. P. Weyerhaeuser Jr., Charles H. Ingram and Howard W. Morgan, all of Tacoma.

•

Halifax Paper Plans Pulp, Paper Mill Improvements

Halifax Paper Co. has recently signed a contract with Ebasco Services Inc. covering extensive improvements at its Roanoke Rapids, N. C. plant.

The over-all project is expected to cost about $1,200,000, according to the parent firm, Albemarle Paper Mfg. Co. of Richmond, Va.

The proposed additions involve improvements in both the pulp mill and No. 3 paper mill. The emphasis will be on the promotion of quality and the reduction of costs. At the same time, however, it is expected that some increase in daily production should result.

Pulp Mill

The improvements in the pulp mill will include the installation of a sextuple effect set of black liquor evaporators manufactured by Goslin-Birmingham Mfg. Co. The units operated alone would have a potential capacity of servicing a daily pulp production of 500 tons. Present production capacity of the plant is 330 tons.

Also to be added are two stages of Improved Machinery valveless vacuum washers having cylinders 11½ ft. in diameter and 20 ft. in width. The line of washers is being erected in such a way that two additional stages could be added at a later date, in which event the line could handle a daily 500 tons of pulp.

The No. 4 Murray-Waern recovery boiler is to be converted from its present service as an oil-fired unit to black liquor recovery boiler, enabling the recovery of the additional chemicals that will be available from the improved washing and evaporation.

Planned for No. 3 mill is the addition of two felt dryers to the paper machine. The dryers will be manufactured by Beloit Iron Works and will improve the operating condition of the dryer felts, increase the drying capacity of the machine, and make improved production possible.

Two finishing jordans will be added to the beater room. They will be supplied by Shartle Bros.

•

PI Expansion Notes . . .

Kimberly-Clark Corp. has purchased a one-third interest in Cellucotton Products Ltd., a British firm that is now expanding its manufacturing facilities for creped wadding.

Longview Fibre Co. of Longview, Wash., has taken an option on an industrial site of about 70 acres near Springfield, Ore., where it expects to build a plant for the manufacture of 9 point corrugating.

OAK PULP in its first appearance at the Nekoosa-Edwards mill. These laps in the wet room receive close examination from Art Bernhardt, assistant pulp mill superintendent

DOZENS OF TESTS gave advance information for guiding the Nepco mill-scale run. Walt Garding is pictured using the proportioner and graduate in the control lab

Oak Proves "Oke" in Nepco Test Run for Hardwood Experiment

SUCCESSFUL MILL-scale runs using local oak pulpwood have recently been completed by Nekoosa-Edwards Paper Co. in Nekoosa, Wis. In each of the runs, the wood was handled into the wood room with existing equipment. The pulping and bleaching was carried out in the sulfate mill that was designed to process pine.

The first showing of how oak will perform in Nepco's proposed sulfate pulp mill addition for hardwoods was obtained when 68 cords were processed in the present plant.

Burt Kassing, director of process and product development, and Dr. T. A. Pascoe, research director, reported the success of the test. They planned the test runs, the principal purpose of which were to translate research and development results into actual operating experience.

New Link in the Chain

Considerable planning was necessary on the part of Ed Weinfurter, kraft mill superintendent, and Art Bernhardt, assistant superintendent, to fit an "oak pulp link" into the normal pine pulp "chain" for the continuous washing, screening and bleaching.

The oak chips were prepared and stored in a separate bin in the regular chip storage. Since oak chips are 1.4 times as heavy per cu. ft. as pine, the chemical charge was adjusted accordingly.

These mill-scale studies started off in each instance with a plan that would yield needed information on such items as the suitable length of pulpwood sticks and handling equipment that would be required if a different length than pine were used. The barking of oak wood was recognized as posing a problem unlike any that had been encountered before. Accordingly, as many phases as possible of this work was incorporated in each run.

Pilot plant cooks had demonstrated that the best schedule for pulping oak was somewhat different than that for pine. Wood density differences between oak and pine account for the fact that a digester will yield considerably more pulp per blow when cooking oak than when cooking pine.

The oak pulps made in these trials were washed by putting them over the regular counter current, vacuum washing system.

According to a spokesman for Nekoosa-Edwards, the experience

TECHNICAL AND RESEARCH men were pleased with the first machine runs using oak pulp. Shown inspecting a test sheet of printing paper are (l to r) Pat Hassett and Ed Gramban, paper mill chemists, and Dr. T. A. Pascoe, research director

gained in washing this pulp has given valuable design information leading toward an eventual independent production line. It was not unexpected that the short-fiber oak pulp could not be run on the vacuum washers at the same production rate as the long-fiber pine.

Bleaching the new pulp in the regular multi-stage bleach plant presented few problems. Small problems that were encountered in this department were related to the different behavior of the hardwood pulp on vacuum washers as compared with pine.

The bleached pulp was lapped in each run on the Kamyr wet machine.

Research Predictions Confirmed

A number of planned paper machine runs have been made using the bleached oak sulfate in the furnish. Results from these runs, measured in terms of paper qualities, have borne out research predictions that bleached oak sulfate would be a desirable papermaking pulp.

Following a close study of the results of the mill trials, one member of the Nepco management summarized the situation: the only real adverse factor is that the new pulp is not available in quantity for regular use.

•

Lower Costs Claimed for New French Pulp Process

A "revolutionary and successful" nitric acid process for making pulp has been perfected in France and is being introduced into the United States. It is claimed that the process reduces plant investment up to 60 per cent and production costs by about 20 per cent.

The patented method — known as the Delbay process — does not attack the cellulose, thereby preserving the natural length of the fibers. According to the Council on Public Relations in New York, N. Y., the process does not require barking and can therefore be applied to any kind or size of wood or cellulose plants, such as branches, brush wood, straw or bagasse. This in turn, it is said, makes it possible to produce from them "the best paper," including newsprint.

It is calimed that the Delbay method eliminates the problem of water pollution. The residual water is neutral, clear and odorless. Furthermore, the volume of water required is only a fraction of that used in the present standard methods.

No complicated machinery is used, and the process is a "cold" one, eliminating fuel costs. It was devised by G. Desorbay and P. Delcroix.

Newsprint Supply and Demand to Increase in 1955, NAC Finds

WORLD NEWSPRINT supply and demand continued to rise through 1954, and further increases are in prospect for this year. This according to the Newsprint Association of Canada in its booklet, "Newsprint Data: 1954."

"In recent years," the NAC declares, "the world newsprint situation has presented a picture of growing demands and of increased capacity and production to meet these demands." It is pointed out that the North American market was in 1954 expected to take more than 6,500,000 tons of newsprint, nearly 2,000,000 tons more than in 1946. European consumers were to require about 2,600,000 tons, or more than double the 1946 figure. Supply to the rest of the world was expected to reach 2,600,000 tons, again double the 1946 level.

A continued growth in world newsprint requirements and in the availability of supply to meet those requirements has occurred through 1954 and is in prospect for 1955. Based on current estimates for this year, world production and supply will exceed 12,000,000 tons, more than 4,000,000 tons above prewar and some 5,000,000 tons over 1946 levels.

Production Increases

On the production side, increases in 1954 were expected in 21 of the 30 producing countries, excluding the Soviet Bloc nations about which little is known. The size of the increases by individual countries varied widely, but Canada alone was predicted to have contributed about 240,000 tons, or 43 per cent of the total.

On the consumption side, as measured by supply taken, the gains for 1954 were widely spread over many countries, particularly those in Europe where there has been a marked economic upsurge. In the United States, the largest single market, consumption was maintained despite a mild recession.

For North America, it is expected that during 1955 tonnage will increase to 7,465,000. Of this total, Canada will claim 6,040,000 tons. Present North American tonnage stands at about 7,200,000, with Canada boasting 5,920,000. Thus, during this year it is thought that Canadian and U. S. production will be increased by 265,000 tons. (This in-

World Newsprint Capacity

Country	1939	1952	1953	1954	1955
Canada	4,632,936	5,510,397	5,722,640	5,919,917	6,040,000
U.S A.	972,000	1,165,000	1,170,000	1,280,000	1,425,000
Argentina	0	35,000	35,000	55,000	55,000
Brazil	10,000	45,000	45,000	45,000	45,000
Chile	11,000	20,000	20,000	20,000	20,000
Peru	0	15,000	15,000	15,000	15,000
Britain	1,100,000	672,000	675,000	705,000	730,000
Finland	611,000	547,000	547,000	569,000	730,000
Norway	251,528	219,000	219,000	232,000	228,000
Sweden	358,890	392,000	375,000	375,000	390,000
Austria	85,000	165,000	200,000	210,000	210,000
Belgium	78,000	77,000	66,000	66,000	66,000
France	556,550	355,000	375,000	375,000	380,000
German Republic	270,605	217,000	235,000	250,000	265,000
Netherlands	110,230	113,000	113,000	115,000	115,000
Portugal	2,000	3,000	3,000	3,000	3,000
Switzerland	40,000	60,000	60,000	66,000	66,000
Italy	85,430	140,000	145,000	150,000	160,000
Spain	40,000	44,000	50,000	50,000	50,000
Turkey	0	12,000	12,000	12,000	12,000
Yugoslavia	0	500	0	0	0
Egypt	0	3,000	3,000	3,000	3,000
Israel	0	0	0	15,000	15,000
India	0	0	0	0	30,000
China	26,000	80,000	85,000	90,000	90,000
Taiwan (Formosa)	Japan	8,500	9,000	9,000	10,000
Japan	450,000	378,000	522,000	562,000	593,000
South Korea	Japan	30,000	30,000	30,000	30,000
Australia	0	85,000	85,000	85,000	85,000
New Zealand	0	0	0	0	8,000
Sub-Total	9,691,169	10,391,397	10,816,640	11,306,917	11,869,000
Russian Bloc	723,420	891,000	927,000	927,000	927,000
World Total	10,414,589	11,282,397	11,743,640	12,233,917	12,796,000

1954-55 estimated

cludes improvements to existing machines and new machines or mills.)

New Projects and Prospects

Public announcements have already appeared concerning several new North American mills:

Celgar Development Co. has been considering plans for the erection of a mill near Arrow Lakes in British Columbia. It is thought that a 400-ton pulp mill and a 275-ton newsprint mill will be built.

Kitimat Pulp & Paper Co. has been incorporated in British Columbia. Ultimate newsprint capacity has been estimated at 400 to 500 daily tons.

Southland Paper Mills has already started construction on the housing for a third newsprint machine at its Lufkin, Texas mill. The machine will have an annual capacity of 77,000 tons and is expected to be in operation in 1956.

Coosa River Newsprint Co. has announced plans to invest $3,000,000 in a two-year expansion program at its Alabama mill. Some 20,000 to 25,000 tons will be added to present capacity.

Bowaters Southern Paper Corp. has announced plans for an expansion program intended ultimately to raise the capacity of the new Tennessee mill from the present 130,000 tons to 275,000 tons per year.

•

Great Northern Makes First Hardwood News in Commercial Volume

The first commercial-volume high-quality newsprint from hardwood has been produced by Great Northern Paper Co. at East Millinocket, Maine. The achievement was a part of the first phase of a record-capacity mill expansion project just completed by the firm.

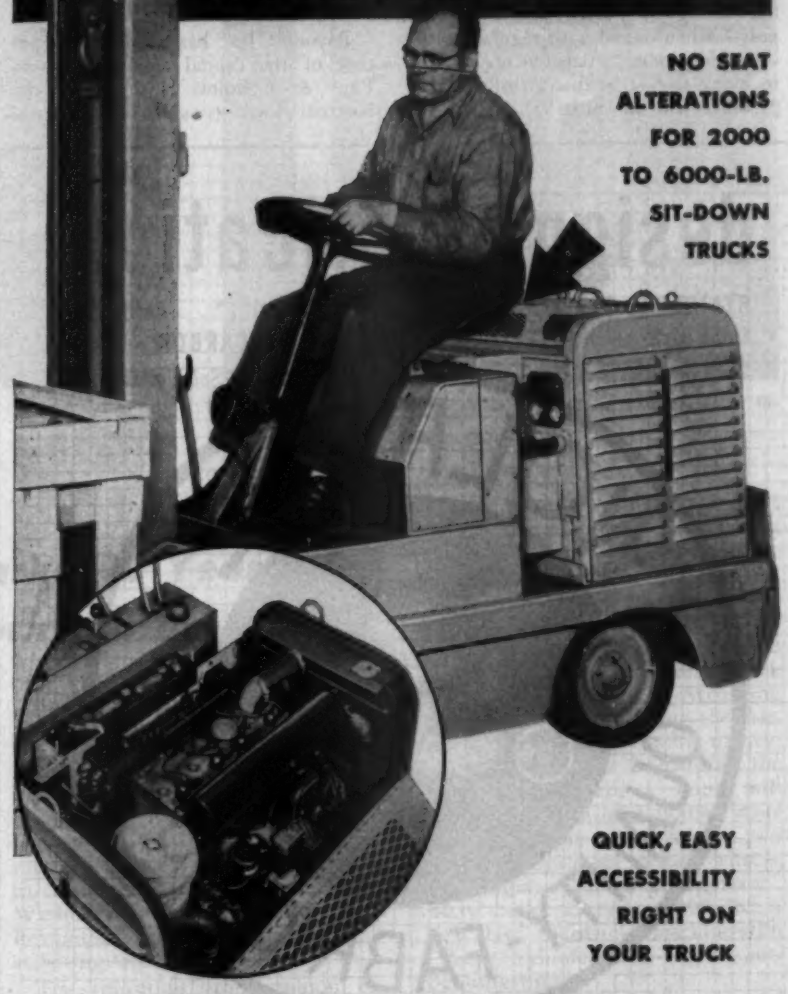
The initial expansion is scheduled to add 500 tons of daily capacity to the existing mill, with all equipment designed for an ultimate new daily output of 800 tons of newsprint.

Although hardwoods have been used for kraft and other kinds of paper, Great Northern pioneered their use in newsprint by first initiating and then operating a 50-ton commercial pilot chemi-groundwood pulp mill that proved that a high percentage of hardwoods could be successfully used to produce fine quality newsprint in commercial volume.

The chemi-groundwood process used at East Millinocket is of an entirely original design, with two di-

New Interchangeable Gas-Electric Power Unit Gives Big Advantages

READY-POWER INTRODUCES MODEL HA-3



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gesters capable of pulping a minimum of 150 tons of hardwood daily. The process had not been previously used commercially in any volume. Exhaustive tests showed that available hardwoods could be pulped at a substantial saving of power, and that this pulp—when mixed with regular pulps—would produce a paper at least equal in every respect to that already being produced by the firm.

Stone & Webster Corp. designed the chemi-groundwood plant and was awarded the entire construction contract, including the engineering and design for the steam power installation.

•

Rayonier Acquires 80% of Alaska Pine; Announces $8,000,000 Expansion

Rayonier Inc. has acquired 80 per cent of the capital stock of Alaska Pine & Cellulose Ltd. from the Koerner interests and from Abitibi Power & Paper Co. Ltd. The announcement was made by Clyde B. Morgan, president of Rayonier.

Mr. Morgan also announced that Alaska Pine intends to invest $8,000,000 in its Port Alice, B. C. facilities and will in addition construct a silvichemical manufacturing unit.

The expenditures to be made at the Port Alice mill will increase its capacity and make it a more flexible, versatile unit.

•

Stone Container Boosts Capacity at Chicago Corrugated Box Plant

Capacity has been increased and production speeded at the Chicago corrugated box plant of Stone Container Corp. The recently completed $10,000,000 improvement program included the installation of 10 new machines, a 25 per cent increase in the manufacturing floor space, and an unusual conveyor that tows industrial trucks throughout the plant.

PORTION OF the plant-wide chain conveyor system at Stone Container Corp.'s Chicago operation. The continuously-moving 2025-ft. conveyor links all production departments

The continuously moving conveyor, sunk in the floor with only towing pins protruding, is believed to be the only one of its kind in the corrugated box industry. It extends to all production departments and warehousing and shipping areas, returning empty trucks.

Stone has added three new presses to form a battery of nine high-speed, two-color machines. Hydraulic truck-levelers have been installed to lift or lower rear wheels of motor trucks and trailers so that their floors are even with the floor of the shipping dock.

The 2025-ft. conveyor chain moves continuously at 30 fpm. At 15-ft. intervals 135 towing pins project 2 in. above floor level. All 1200 of the firm's 6- by 3-ft. hand trucks have been equipped with hitches for easy coupling and uncoupling.

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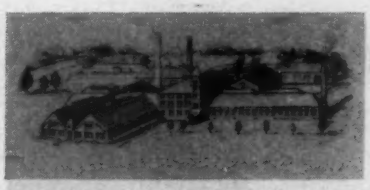
P. H. Glatfelter Co.—1875



P. H. Glatfelter Co.—1900

P. H. Glatfelter Co.—1930

THE SPRING GROVE plant as it looks today, 90 years after the company was founded

OPEN HOUSE visitors are shown Nos. 1 and 2 machines at the Glatfelter Co. plant

From Iron Ore to Paper . . .

P. H. Glatfelter Marks 90 Years of Papermaking at Spring Grove

AT ABOUT THE SAME time that Abraham Lincoln was dedicating the battle field at Gettysburg, Pa., the first P. H. Glatfelter was founding in near-by Spring Grove what was to become one of the largest manufacturing plants of its kind in the United States.

The paper mill and property purchased by the young man for $14,000 on December 23, 1863, now has total assets of more than $16,000,000. The one-time iron foundry had a daily capacity of about 1500 lb. of paper.

This fall the sprawling P. H. Glatfelter Co. held open house on the occasion of its 90th birthday. More than 5000 visitors toured the plant. At that time, P. H. Glatfelter, board chairman, laid the cornerstone for the firm's latest expansion, which represents an investment of more than $4,000,000.

This newest addition includes the bleach plant and chlorine dioxide generating equipment that makes the firm the first in the United States to use a three-stage chlorine dioxide bleaching process. Also new to the mill is a chemicals recovery plant.

The manufacturing of paper was begun in the south central Pennsylvania area by a man named Jacob Hauer. Prior to that time the principal means of livelihood in the region had been the mining of the high-grade iron ore that abounded in the backwoods country.

Iron masters were common and bloomeries plentiful. The foundries turned out everything from stoves to cannon. Much of the cannon for Washington's army of the American Revolution had been manufactured at Spring Grove.

The transition from cannon to paper came when Hauer bought an abandoned forge and began producing paper from straw collected from farmers in the area. Hauer died in 1853, but his heirs continued the operation for some years. They later leased the business to a Philadelphia firm, but in 1863 the property "went on the block" at what was then known as an Orphans' Court sale.

It was at this time that the first P. H. Glatfelter, then only 27 years of age, entered the picture.

From Timber to Fourdrinier

The young man had been born on his father's farm in York County, Pa., and had had early experience in papermaking. From 1857 to 1863 he had been employed by Loucks & Hoffman at Paper Mill, Md., on the Gunpowder River.

When Glatfelter learned of the impending sale of the mill in his native county, he hurried home and purchased the property "lock, stock and barrel" for $14,000. According to the handbill announcing the sale, here is what he got for his money:

A 101-acre tract known as the Spring Paper Mill, a stone mill house, frame machine house, stone stock house, four tenant houses, two improved Burnham water wheels, four engines "of large capacity," rotary boiler carrying 2000 lb., a "first class" fourdrinier machine with a 62-in. cylinder, and "good surrounding timber."

According to available records, the output capacity of the mill was then about 1500 lb. of paper per day. This was increased to 4000 lb. in 1868.

Business Good, Expansion Needed

It was at about this time that the first "P. H." decided that business was good enough to warrant a little expansion. He contracted to have new buildings constructed and soon after ordered brand new machinery. Mill capacity under the direction of the founder had been increased to 5 tons daily; the value of the property had jumped from $14,000 to more than $200,000.

The property has been passed

down through the generations of the Glatfelter family, and today the business is managed by the third generation—P. H. Glatfelter III.

From Pine to Hardwoods

Today, the company uses 77,625 cords of wood in a normal operating year. This amounts to about 621,000 trees of several varieties, such as pine, poplar, gum, rock oak and mixed hardwoods.

The latest figures indicate that Glatfelter produces a daily 220 tons of specialty papers and 150 tons of sulfate pulp.

Plant space provides storage for about 25,000 cords of pulpwood. This amount represents approximately that needed for four months of normal operation.

•

Forest Management License Granted to Kitimat P & P

A $65,000,000 pulp and newsprint mill at Kitimat, B. C., is closer to realization with the granting of a conditional forest management license by the provincial government. The mill will be built by Kitimat Pulp & Paper Co. Ltd., jointly owned by Aluminum Co. of Canada Ltd. and Powell River Co. Ltd.

In Vancouver, Frank H. Brown, president of Kitimat, said that the final decision to proceed with the project will depend on the favorable outcome of detailed forest surveys and a number of other factors. "Conditions in the newsprint and pulp markets and economy will also have an important bearing."

A NEW WAY of mixing wood pulp and chlorine dioxide solutions in polyethylene bags instead of glass jars makes possible safer and more accurate pulp-bleaching tests. The development won for E. S. Lewis of the U. S. Forest Products Laboratory in Madison, Wis., a U. S. Department of Agriculture award. By gathering the top of the bag closely about a graduated pipette (left), loss of vapor is minimized upon addition of chlorine dioxide to the pulp. Pulp and reagent are then mixed uniformly and quickly as the bag is kneaded (right). Bags are made of film as thin as 0.004 in. at 50°C.

New USFS Field Office Set Up at Wausau

A new field office of the Lake States Forest Experiment Station of the United States Forest Service has been opened in Wausau, Wis. In charge is Robert Ralston, a research forester from East Lansing, Mich.

Principal objective of the new office will be to perform experimental work in an effort to achieve management and utilization of low-grade, non-usable species of oak, aspen, and northern hardwoods. The latter will receive special attention in view of their increasing use as pulpwood.

•

Battle Against Forest Insects and Disease Outlined by Everest

A four-point program to stamp out the forest insect and disease menace was issued recently by D. C. Everest, chairman of the board of Marathon Corp. He spoke at the annual Lake States and Canada Forestry Conference in Wisconsin Rapids, Wis.

Mr. Everest's program included: (1) Positive definition of the responsible state agency by legislation; (2) delineation of authority and responsibility and an outline of legal procedure by legislation; (3) development of an adequate detection and control organization, and (4) maintenance of an adequately staffed and financed research program.

Urging practical application of research in the control of forest insects and disease, Mr. Everest declared that the risk from fire has

65 BILLIONTH PAPER milk container is presented to Secretary of Agriculture Ezra Taft Benson by William F. May (l), general manager of American Can Co.'s fiber milk container department, and E. M. Norton, executive director of the National Milk Producers' Federation; at the right is Patrick B. Healy, special services director of NMPF; nearly half of the nation's beverage milk is now being packaged in paper containers, and a record-breaking volume of 10.5 billion units was expected to be produced in 1954—the 20th anniversary of the first commercially successful paper milk bottle

decreased while the danger from insects and disease is increasing. "This is a concern of industry and also a public concern," he said.

He suggested that authority and responsibility for forest pest control be vested with the respective states. The federal government should aid in research and protection of the national forests. State work, he added, should be established within the frameworks of conservation departments.

Financing of the program could be done with a forestry mill tax assessment, Mr. Everest concluded.

•

Wood Increases Lead as Chief Paper Raw Material

Although 10 other fibers can be pulped for papermaking and have been extensively used, wood steadily increases its lead as the chief raw material of paper. The trend will continue. The demand for pulpwood will go up 50 per cent in the next 25 years.

According to Herman Work and W. S. Bromley, the situation calls for a correlated program to lift wood production. Work and Bromley have recently published "Our Papermakers Look to the Woods" for the semi-annual volume of monographs printed by Hercules Powder Co. Mr. Bromley is executive secretary of the American Pulpwood Association; Colonel Work is a forest consultant in Staunton, Va.

The pulp industry is making tremendous strides toward providing for its own needs by direct efforts, the authors assert. "Not only is the industry learning how to grow and harvest wood of the favored species, but it is finding ways of using more kinds of wood. Intensive use of wood leftovers from other industries has been most helpful, meeting a part of the pulpwood requirements without the necessity of cutting additional trees."

Selling good forest care to the owner of small acreage will be "the most difficult and biggest pulpwood problem for a long time. The separate ownerships are small, but the aggregate is huge, and the land productive. Most foresters agree that good forest practices can increase wood growth anywhere from 50 to 100 per cent on a large part of the 261,000,000 acres that are the aggregate of the small holdings."

More Government Land

According to the authors, the pulp industry doubled its pulping capacity from 1939 to 1950 and is still

A Plain Case of

TWO HEADS BEING BETTER . . .

•

THE CASE OF FOAM CONTROL!

•

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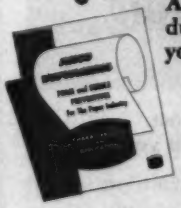

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adding capacity. This, they say, illustrates the quickened demand for the principal raw material for paper.

They believe that stable land ownership, a situation aiding pulpwood production, will increase during the next 20-30 years. Pulp firms bought 11,500,000 acres between 1945 and 1952 and now own 28,000,000 acres. Since that pace of company land-buying is unlikely to continue, the small landowners' opportunity for profit from pulpwood will consequently increase.

From the standpoint of good forestry, Work and Bromley declare, government lands should figure in pulpwood production more than they do. "The (federal) Forest Service has conceived of its mission as supplying sawlogs rather than pulpwood but is now coming to realize that it has a responsibility to support the production of pulp and paper as well."

As for state-held land, "many (acres) . . . are now badly in need of cutting to remove trees of little promise and to open up roads that can be used for protection against fire and epidemics as well as for hauling wood. Nationwide, there is a need for accepted plans for continuous purposeful management, to allow for sales of timber as well as for recreation and other uses. Many states need to work out a settled policy by which all commercial forest land would be handled by a single agency empowered to sell timber as that becomes desirable from the standpoint of good land management."

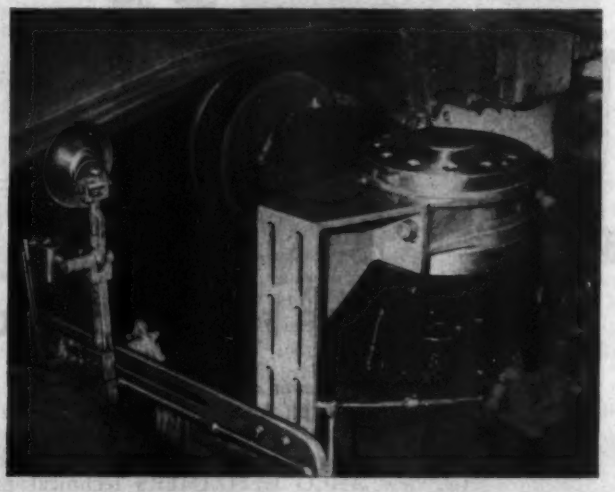
NEW DOWINGTOWN Mfg. Co. dryer section that was recently placed in operation at Lowe Paper Co. in Ridgefield, N. J. The forty-six 48-in. diameter dryers have 98-in. faces and are arranged in a raised two-deck section

PI Expansion Notes

Diamond Match Co. is negotiating for the sale of its Plattsburg, N. Y., paper mill to the James C. Wemyss interests. According to Robert G. Fairburn, Diamond president, the move is "part of a company program looking toward more effective integration of wood fiber processing from controlled sources of timber." The Plattsburg mill makes napkins, towels, toilet tissue and household waxed paper. Diamond will continue to manufacture pie, picnic and dinner plates, and trays for food prepackaging.

East Texas Pulp & Paper Co. has started operations in its new mill near Evadale, Texas. The plant, a joint project of Time Inc. and Houston Oil Co. of Texas, will produce a daily 300 tons of bleached kraft market pulp, bleached fourdrinier board, and heavy-weight bleached paper.

Minnesota & Ontario Paper Co. is completely modernizing the white water system at the Fort Frances, Ont. groundwood specialty paper and newsprint mill. Decker improvements will include the installation of eight 48-in. by 131-in. Hymac Cowan deckers. Also included in the installation will be stainless steel



teaching a wire to toe the line...

It's model 706, new Gilbert & Nash Hydra Guide with rotary palm* for wire, wet felt, and dryer felt service. Shown in actual use—now in its second year—at Sorg Paper Company, Middletown, Ohio, #6 machine, Smith mill.

High speed machines—even variable speed machines—are no handicap to model 706. Its guide roll moves only in a *horizontal* plane to avoid undue wire stretch . . . continuously corrects at a plus or minus 1/64 inch . . . eliminates over-correction or hunting.

Hydraulically operated by water pressure—where filtered water pressure is 40 to 60 lbs.—or by oil pressure with a pump of one gallon per minute capacity. Send for free Hydra Guide folder or, at no obligation, write for a Gilbert & Nash representative to call at your mill.

GILBERT and NASH APPLETON, WISCONSIN

*Manufactured and sold exclusively by The Appleton Machine Company

supply and discharge headers and tile-lined white water and fine screen accepted stock channels. Each paper machine will be placed on a closed white water system with overflow pumped to the new white water storage tanks. Supply to the Vortex beater will be completely altered to eliminate pressure surges and will result in speeding up the beating cycle.

W. R. Grace & Co. has announced a $1,500,000 project to provide a 50 per cent increase in production at its bagasse pulp and paper mill in Paramonga, Peru. Included will be the installation of a 110-in. five-cylinder paper machine now being built by Sandy Hill Iron & Brass Works. The machine, which is to be placed in operation this year, will run at 300 fpm and will initially produce approximately 40 tons daily.

Kimberly-Clark Corp. has announced that it has taken options to purchase approximately 50 acres of property in Fullerton, Cal., as a possible future site for expanding creped wadding operations.

Publishers' Paper Co. has purchased the property of Oregon City Mfg. Co. in what is reported to have been a $1,000,000 deal.

Coming Events

TAPPI

Jan. 14-15—Southeastern Section, Francis Marion Hotel, Charleston, S. C.
Jan. 27—Delaware Valley Section, Engineers' Club, Philadelphia
Feb. 2—Empire State Section, Western District, J. W. Clement Co., Buffalo, N. Y.
Feb. 10—Ohio Section, American Legion Hall, Middletown, Ohio
Feb. 21-24—Annual Meeting, Commodore Hotel, New York, N. Y.

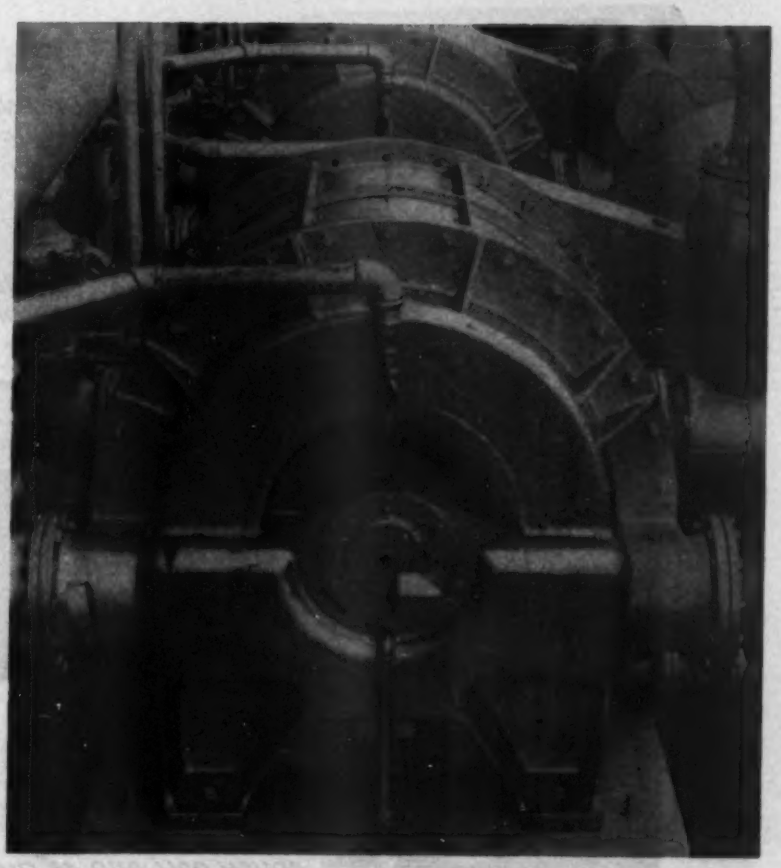
American Pulp & Paper Mill Superintendents Association

Jan. 21—Connecticut Valley Division, Roger Smith Hotel, Holyoke, Mass.
Jan. 27—Miami Valley Division, Middletown, Ohio
Feb. 17—Michigan Division, Hotel Harris, Kalamazoo

Other meetings

Jan. 24-27—Plant Maintenance & Engineering Conference and Exhibition, International Amphitheater, Chicago
Jan. 24-28—International Heating & Ventilating Exposition, Commercial Museum and Convention Hall, Philadelphia
Jan. 26-28—Canadian Pulp & Paper Association, Technical Section, Mount Royal Hotel, Montreal, Que.
Feb. 21-24—American Paper & Pulp Association, Annual Meeting, Waldorf-Astoria Hotel, New York, N. Y.

High machine speeds?
High temperature headbox stock?
You need NASH Vacuum Pumps!



Air from the suction rolls on paper machines carries with it substantial quantities of moisture. This considerably reduces the effective air handling capacity of any vacuum pump except the Nash. In the Nash Vacuum Pump, because of the unique principle of operation, the bulk of this vapor is effectively condensed inside the pump. The total capacity of a Nash is therefore increased.

When you specify a Nash Pump it can be closely sized to the job. It is not necessary to select an over-sized unit, because the rated capacity of the Nash may be relied upon.

That is one of the reasons why Nash Vacuum Pumps are installed in over a thousand leading Paper Mills. An engineer from Nash will be glad to survey your mill, and make recommendations, entirely without obligation to you.

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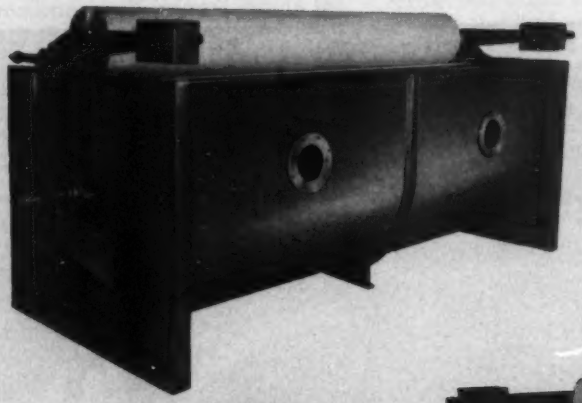
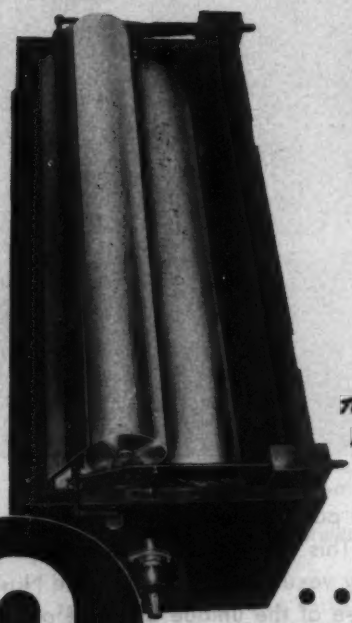
ANY WAY YOU LOOK AT IT...



VIEW OF END AND INTAKE SIDE OF COWAN DECKER

VIEW OF EFFLUENT DISCHARGE END FROM INTAKE SIDE



TOP VIEW SHOWING RUBBER-COVERED COUCH ROLL AND 48"DIA.– 131" CYLINDER MOULD

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COWAN DECKER PRODUCTION FIGURES:

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85 tons/day — Sulphite
100 tons/day — Kraft

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Exclusive U.S. licensee for Cowan Deckers

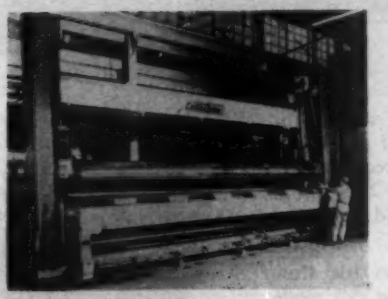
ALLIED NEWS

B-C International to Build Deculator Process in England

Black-Clawson International Ltd. of London, England, and Rotareaed Corp. of Bronxville, N. Y., have completed arrangements whereby the Deculator process will be manufactured and sold by B-C International in the British Isles. (The firm is a division of the Black-Clawson Co. of Hamilton, Ohio.)

The arrangement enables B-C International to manufacture, sell and service the Deculator process in England and certain European papermaking countries. The United States and Canada are served by Rotareaed and Rotareaed of Canada Ltd., respectively.

The process is a patented system for deaerating all headbox furnish ahead of the paper machine.



NEW IMPERIAL "100" winder built by Cameron Machine Co. of Brooklyn, N. Y., for Bowater-Lloyd Pulp & Paper Co. of Kent, England, is shown getting the final roll polishing operation prior to test runs at Cameron's plant in Dover, N. J. The unit has a 276-in. trim width, a rewind capacity of 72-in. diameter, and is capable of speeds up to 5000 fpm. It boasts several new features contributing to higher roll production and ease of operation

Allied News Notes . .

Bagley-Sewall Corp., a division of Black-Clawson, has announced the termination of agreements with the Dan Charles Agency of Seattle, West Coast representative of the former Bagley & Sewall Co. Gordon Petrie, B-C's West Coast sales manager, has assumed full representation of the Bagley-Sewall Div.

E. I. duPont de Nemours & Co. has completed a new laboratory at Newark, N. J., for research on pigment colors.

Buffalo-Electro-Chemical Co. Inc. and Becco Sales Corp. have been officially merged with the parent firm, Food Machinery & Chemical Corp. The new name will be the Becco Chemical Div. of Food Machinery & Chemical.

Two Hercules Powder Co. facilities at Hopewell, Va., have been consolidated as the Virginia Cellulose Department. One plant produces chemical cotton, while the other turns out ethyl cellulose and CMC (sodium carboxymethylcellulose). Floyd L. Boddicker is in charge.

Moore & White Co. will in the future concentrate on the engineering of new products, improving old products and customer service. M & W has contracted with H. W. Butterworth & Sons Co. of Bethayres, Pa., to continue the production of present lines and new products.

Reichhold Chemicals Inc. has entered the field of wood preservatives with the establishment in Seattle of a pilot plant for the production of pentachlorophenol.

Frank W. Egan & Co. has broken ground for a new plant at Somerville, N. J. The 14,000-sq. ft. plant will include offices, shop, erection bay and laboratory.

The Babcock & Wilcox Co. has purchased the assets and business of Globe Steel Tubes Co. of Milwaukee. The plant, which manufactures seamless and welded stainless, alloy and carbon steel tubing as well as a variety of aircraft tubing, pressure tubing and welding fittings, will be operated as part of B&W's Tubular Products Div.

E. I. duPont de Nemours & Co. will begin construction in April of its $15,000,000 neoprene synthetic rubber plant near Muskegon, Mich.

Hamer Valves Inc. of Long Beach, Cal., has named Shelby Jones Co. as exclusive sales representatives in eastern Pennsylvania, Delaware and southern New Jersey. Shelby Jones has its headquarters in Havertown, Pa.

Cog Engineering Products Co. is a newly formed Chicago firm specializing in methods and manufacturing machinery for continuous process industries. The president, George M. Kovac, was formerly vice president in charge of sales, export and new developments for W. J. Fitzpatrick Co.

American Well Works of Aurora, Ill., has named Water & Sewage Equipment Co. of Minneapolis as sales representative for Minnesota and North and South Dakota.

Allied Personalities

Charles R. Herter has been made manager of the Detroit district office of J. O. Ross Engineering Corp. He was formerly with Drying Systems.

John W. Natwick, associated with the pulp and paper industry for more than 25 years, has been made a sales engineer with the paper and pulp department of Jackson & Church Co. of Saginaw, Mich. He was formerly superintendent and technical director for Crossett Paper Mill.

David W. Stapleton has been named executive vice president of Stowe-Woodward Inc. He was former general manager of Udylite Corp.

W. D. (Bill) Haskell has been named assistant sales manager of the Dilts Machine Works Div. of the Black-Clawson Co. at Fulton, N. Y. Mr. Haskell joined Dilts in 1939 and joined the sales department in 1946.

W. D. Haskell

Dr. D. B. Wicker

Dr. Dan B. Wicker has been appointed assistant director of research in charge of physical research for F. C. Huyck & Sons of Rensselaer, N. Y. He was formerly in the research laboratories of American Cyanamid Co.

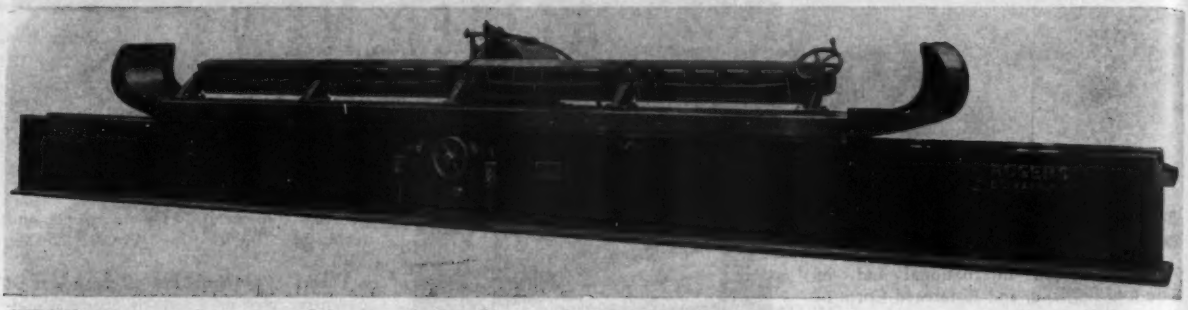
Irving B. Purdy has been elected vice president of Merritt-Chapman & Scott Corp. and will be responsible for the administration of the firm's Industrial and Building Construction Div. Edwin A. Pasha, divisional vice president, will be responsible for operations in the field.

Chicago Bridge & Iron Co. has announced the election of three new members to the board of directors: George S. Trees, assistant general sales manager; Fred Goldsby, vice president and general sales manager, and H. J. Clarke, vice president and manager of erection.

William M. Gallahue has been named general sales manager of Mount Hope Machinery Co. The appointment will enable Walter Murray, technical sales director, to devote full time to customer relations and field engineering problems. Mr Gallahue was formerly industrial sales manager for the Electronic Div. of American Machine & Foundry Co.

Stein, Hall & Co. Inc. of New York, N. Y., has announced the appointment of Kenneth Arnold as manager of the paper mills department, Robert Hahn as manager of the Chicago sales branch, and Clement D. Nevin Jr., as acting manager of the Cincinnati sales branch. Mr. Arnold was foremerly manager in Chicago.

ROGERS SERIES 220 MASSIVE KNIFE GRINDER



SERIES 220 . . . is a powerful, new design for high production and fast grinding of all heavy duty straight chipper and paper knives. Model illustrated above handles knives up to 220" long. Its sturdy cabinet base is 30' long and its entire weight is more than 10 tons.

Variable reversing motor drive allows for slow and fast table traverse. Self-aligning 5" wide V-ways on cabinet base and carriage absorb grinding pressures, permit heavy cuts without vibration. Magnetic chucks are available to further speed the grinding cycle and reduce setting time.

Other features assure long life and accuracy. Ask about the Series 220 . . . many sizes. Write today!

Manufactured by

Rogers CC-4 Slitter Knife Grinder

CC-4 has been designed for heavy duty grinding of the top and bottom slitters equipped with a 2-speed ball bearing heavy duty spindle. Knife life can be increased as much as 30% . . . . . keep your knives in their original fine cutting condition.

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Doctor Blades

- 2 -

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Doctor Blade Holders

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LODDING

Complete Doctors

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LODDING ENGINEERING CORP.

Worcester, Massachusetts

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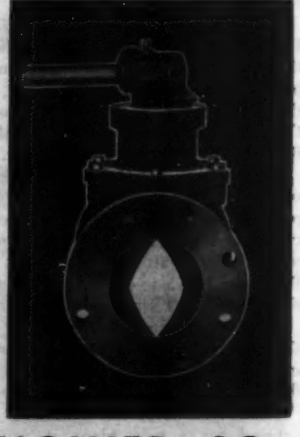
You can set a DeZurik Vee-Port Valve at any point desired . . . . . from wide open to minimum flow . . . . yet the diamond-shaped orifice retains exactly the same shape. These valves provide easy, precise throttling, insure a constant, uniform rate of discharge at any setting. Available in sizes from 3" to 16", with lever, gear or cylinder operators, and with automatic-control positioners. Write for details.



DeZURIK SHOWER CO.

Representatives in principal cities

SARTELL, MINNESOTA

Market Outlook

(continued from page 993)

paperboard and dissolving and special alpha grades. This can be done for the year 1947 from census data, but I regret having to state that data for a more recent year will not become available until 1956, when the results of the Census of Manufactures for the year 1954 will be published. It will, however, be of interest to briefly consider the data for 1947 when, according to this report, 3,379,000 tons of bleached pulp, consisting of 1,792,000 tons of sulfite, 1,068,000 tons of sulfate, and 519,651 tons of soda, were used in the manufacture of paper and board grades totalling 13,809,000 tons. Classifications, the output of which amounted to about 7.5 million tons, were reported as using no bleached pulp. Of the total quantity of such pulp used, slightly more than 3 million tons, equal to 92 per cent of the total, went into paper and the remaining amount into paperboard.

Considering the individual groupings which the Bureau used for this purpose, we find that 83 per cent of the wood pulp used by manufacturers of book, fine and absorbent paper was of bleached grades. For tissue and sanitary this percentage was 29; for coarse and special industrial, 17; bending board, 10; and newsprint and groundwood, 4. Although as I have indicated, comparable data for a more recent year are not available, it is of interest to note that if the same use-pattern for bleached pulp had prevailed in 1953 the total quantity of such pulp consumed would have amounted to about 4 million tons. We know, however, that in 1953 about 5.5 million tons of fully bleached chemical pulp of papermaking grades were consumed by the industry, 1.5 million tons more than was derived by stepping up the 1947 data. This amount, 5.5 million tons, is an increase of 62 per cent over the 1947 quantity and 38 per cent more than the hypothetical figure for 1953. This is a striking rise in itself, but if 440 thousand tons of bleached groundwood, production of which was relatively small in 1947, are added to the 1953 figures, the grand total for bleached pulp consumed in the making of paper and paperboard becomes 5.9 million tons and the percentage increase over 1947 rises to 75.

One cannot with a sufficient degree of certainty indicate where the increased usage has occurred, but it is clear that substantial quantities have gone into the food board segment of bending board; tissue and sanitary stock; and printing grades other than newsprint. We know for certain that since 1947 production of food board has increased by about 500 thousands tons and that the output of groundwood papers containing bleached pulp, chemical or mechanical, has increased by 235,000 tons. Thus, a combination of up-grading traditional papers and expansion of the sale of industry products into fields where whiteness is an important factor has been responsible for the increase consumption of bleached pulp. Further, by the end of 1955, when the annual wood pulp capacity will become 22,074,000 tons, the maximum bleaching capacity for papermaking grades of pulp as reported by the Pulp Producers Association will approximate 7 million tons, of which about 6.5 million tons will be fully bleached. Addition of the capacity to produce dissolving and special alpha pulp raises this to slightly more than 8 million tons, and bleaching capacity will represent 36 per cent of the total pulping capacity. In 1947 this percentage was 31.

It has long been said, how truthfully I do not know, that the customer is always right. The customer is now calling for more and more bleached paper products, and I am certain the industry will heed that call.

High density multi-stage bleaching

(continued from page 995)

Rotapulper. The pulp is then diluted to 10-12 per cent consistency and retained in a tank for complete solution of the chlorinated lignin. Proper caustic concentration and retention time at high and medium consistency must be determined by use of the Rotapulper.

The pulp is next pressed to 40 per cent consistency, removing most of the products of reaction. A second chlorination will then be applied. Consistency of the chlorinated pulp will be higher than in the first chlorination because the chlorine demand of the pulp will be lower. After passing through the retention conveyor, the pulp is diluted and pumped to a screw press for dewatering to 40 per cent consistency.

A second caustic treatment is next applied in another Rotapulper. The amount of caustic used and retention time at high and low consistency will be less than that required by the first caustic extraction.

After pressing to 40 per cent consistency, the pulp is ready for treatment with hypochlorite or peroxide. There will be no difficulty in the use of consistencies of 30 per cent or higher in this stage because of the high solubility of hypochlorite and the relatively low percentages needed. Reaction time should be quite short and degradation of pulp correspondingly low. If hypochlorite is used in this fifth stage, the pulp should be diluted and pressed to remove reaction products. The pulp should be then diluted and an anti-chlor such as SO_2 used.

It will be necessary, of course, to provide means for removing knots or nodules from the pulp after bleaching. Deknotting procedures have already been worked out, consisting of a single pass through a Rotapulper at 10-12 per cent consistency.

Evaluation of the process

The bleaching operations suggested above are almost completely hypothetical. The advantages to be derived from high density processing appear obvious from theoretical considerations, actual experience in peroxide bleaching, and occasional laboratory experiments. Unfortunately, the possibilities of high density chlorination and hypochlorite bleaching cannot be investigated on a small laboratory scale.

When the Rotapulper is used for obtaining this high density blending of pulp and bleach, the experiments immediately take on the aspects of pilot plant operations. Several hundred pounds of dry pulp are needed for each complete test. Nearly all of the variables discussed in the preceding pages must be evaluated on this large scale. A project of this magnitude is too costly to be undertaken by a single unsubsidized laboratory but should be sponsored on a cooperative basis by groups which are most likely to benefit from the results.

The laboratory at the University of Florida already is equipped with stainless steel equipment, including screw press, Rotapulper, retention tower, and auxiliary equipment for pilot plant operation. The laboratory has been assured that, where necessary, the equipment will be duplicated with rubber-lined materials for chlorination work. However, the costs of installations, process modifications and routine costs of experimentation are too great to be undertaken without sponsorship. As soon as such sponsorship is assured, it is felt that three months of investigation will prove the merits of high density operations and provide sufficient data for design and cost estimates for commercial installations.

REVOLUTIONARY *New* ROLL WINDER

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We are contributing to the nation's defense program by providing a large part of our increased production facilities for building precision armaments. Civilian orders are filled on a reasonable time basis only.

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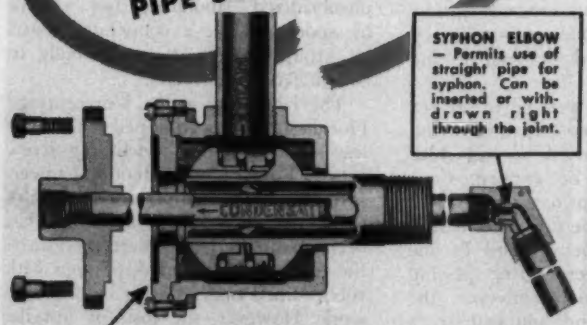
Printers, Embossers, Folders, Interfolders, Waxers, Laminators, Wrapping Machines, Core Winders, Packaging Presses, Crepers and Napkins, Toilet Tissue and Paper Towel Units.

There is no lost motion with the new 60-B *continuous* toilet roll or towel roll winder. Operator simply places uncut core on mandrel and lowers it into receptacle. Machine then *automatically* does everything — cuts the core, winds the rolls to the desired count, cuts off and automatically starts to wind the next mandrel without slowing or stopping. Finished rolls are automatically stripped from mandrel and delivered to wrapping machine through conveyor. Produces positive sheet perforations and sharp, clean-cut edges. Average speed is 1000 feet per minute with constant tension unwind. Machine operates with equal facility on hard type of papers or those of multi-ply facial quality. Built in standard widths up to 81". Machine shown also has attached embossing unit. Write for complete details.

Johnson Joint with SYPHON ELBOW PIPE SUPPORTED TYPE



SYPHON ELBOW — Permits use of straight pipe for syphon. Can be inserted or withdrawn right through the joint.

ASSEMBLY PLATE— Holds internal parts of joint in position when head is removed.

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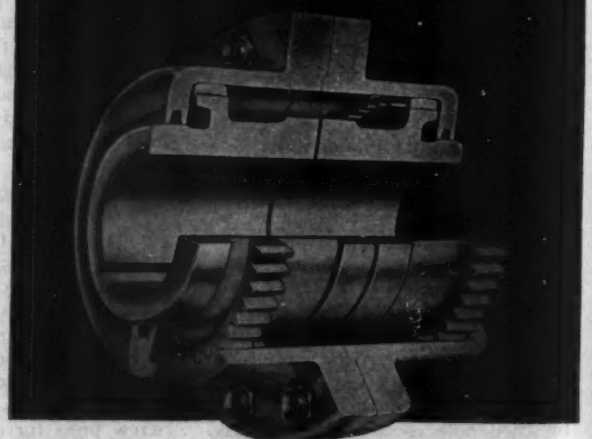

A COPY OF CATALOG GIVING FULL DESCRIPTION AND ENGINEERING DATA SENT UPON REQUEST.

FLEXIBLE COUPLINGS

POOLE FOUNDRY & MACHINE COMPANY — WOODBERRY, BALTIMORE, MD.

Multi-stage bleaching of kraft pulps

(continued from page 1001)

tioned before, there are two reactions going on during each stage. Actually, there are many more including chemical attack of the cellulose, but for the purpose of explaining the practical aspects of bleaching we will consider only two. First is the so-called bleaching or purification reaction which solubilizes or decolors the impurities, and second is the reverse of this reaction which may be called reversion, hydrolysis, reprecipitation, etc. Now, the accepted explanation is that when a high concentration of reaction products are formed, as in the early stages of bleaching, then the reverse reaction prevents further purification without first washing out the impurities. This same explanation also shows why two hypochlorite stages separated by an extraction stage will produce better results than an extraction stage followed by two hypochlorite stages. This does not mean that an infinite number of alternate extractions and hypochlorite stages is the most economical procedure, because we must also include the factor of residual caustic and chlorine at the end of each stage. It boils down to this, that about five stages are the most economical for high brightness kraft pine, but pulps with a lower chlorine demand can get by with fewer stages.

Quality evaluation at each stage

The next portion of this discussion will concern the system of checks and cross checks for quality evaluation at each stage of bleaching at Brunswick Pulp and Paper Co.

First, as a guide as to the amount of chlorine and hypochlorite to be applied, chlorine number (permanganate method) determinations are made on the brown stock and before the two hypochlorite stages. At the same time the residual available chlorine is measured in the washer vats following all but the extraction stage. The pH is determined at the end of the hypochlorite stages. Brightness of the pulp is measured following the second, third and fifth stages. All of these tests are run hourly.

Every four hours a complete set of CuEn viscosity determinations are made from the brown stock to the final stage bleached pulp. Also, every four hours we composite a sample of the pulp from the drying machines for complete physical strength tests.

Dirt and shive counts are made every 20 minutes on each of two drying machines, and you may be surprised to learn that even with all the other tests made in the bleach plant, a high dirt or shive count is sometimes the only symptom of some bleach plant troubles. For instance, pulp which has not received a thorough chlorination will often bleach to a high brightness, but the wood dirt and shives will not be removed. This could be possible due to poor mixing and never show up as a low residual following the chlorination stage, or any of the other checks on bleach plant operations. In addition to all the tests made for control purposes, we also have the operator make an hourly inspection of the pulp on each washer. This serves not only as a check on bleaching but also on screening since our No. 2 washer is the first point in our system where large shives can be seen in case of screen room troubles such as broken screen plates.

The standards of brightness at various points through the bleach plant are the primary standards. In other words, the operator is instructed to produce a given brightness at each stage by increasing or decreasing the temperature as required. Secondly, he must keep the variables residual chlorine and pH within the prescribed limits, and therefore when the temperature is increased he must also increase the chemical dosage, or the pH and residual chlorine will drop below the limits. A limit should be placed on the maximum temperature to be used in each hypochlorite stage. Each stage should be observed over long periods of time to determine the optimum bleaching conditions for a given brightness rise through the stage. It is possible to have many variations and still get the same brightness rise. For instance, consider a stage is at its peak efficiency in chemical consumption, brightness rise, and strength retention: if the per cent available chlorine and buffer are increased so as to start the bleaching stage at a higher pH than normal, and the temperature is increased to compensate for the slower reaction, it is possible to end up with the same brightness gain at higher chemical and steam cost.

Mention should be made of one new use of instrumentation on oxidation potential control of chlorine addition. This is accomplished by automatically adjusting the chlorine flow to hold a given oxidation potential after a short but constant reaction time. Oxidation potential can also be used to continuously record residual chlorine in washer vats.

2 New Neff & Fry Storage Bins

These 30′ x 67′6″ Neff & Fry Bins were recently erected at the Sandersville, Ga., plant of The Thiele Kaolin Company for handling and storing spray-dried coating clays.

This is an example of the thousands of bins we have built to handle more than 80 kinds of flowable bulk materials—principally ashes, cement, clay, coal, grain, gravel, lime, limestone, ore, sand, and wood chips.

Our bins have many advantages which are explained in our interesting folder entitled, "Bins With the Strength of Pillars." A copy is yours for the asking. No representative will call except by invitation.

Request the folder now while it's on your mind.

THE NEFF & FRY CO.
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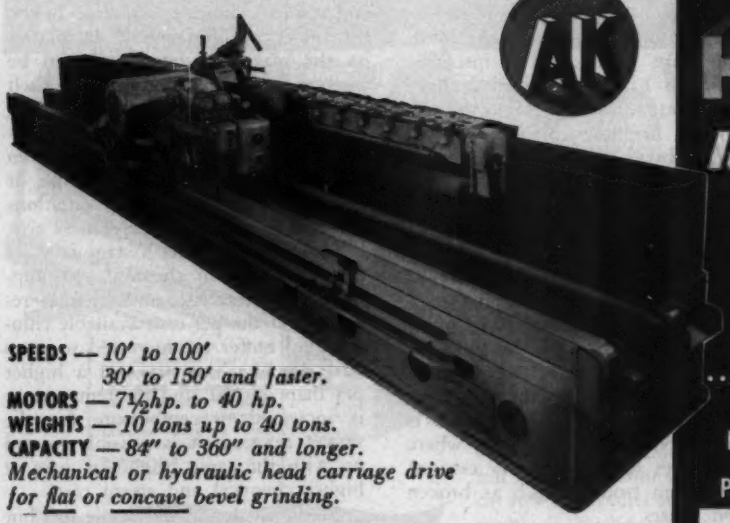

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SPEEDS — 10′ to 100′
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MOTORS — 7½hp. to 40 hp.
WEIGHTS — 10 tons up to 40 tons.
CAPACITY — 84″ to 360″ and longer.
Mechanical or hydraulic head carriage drive for flat or concave bevel grinding.

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CAPACITY 3″ TO 24″ DIAMETER
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1. Every machine builder recommends FDD.
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4. FDD will step up any dryer section—assure uniformly graduated temperatures under automatic control and make for faster, more uniform drying.
5. Close to 1000 FDD systems in service helping close to 1000 machines deliver greater tonnages of more acceptable grades—real profit makers.

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NAMES in the NEWS

Extensive Management Changes Announced by Crown Zellerbach

U. S. and Canadian officials of Crown Zellerbach have announced extensive management changes "designed to enhance" the firm's ability to produce for rapidly expanding markets. Twelve executive and management positions are involved.

In Canada, Frank W. Youngman has been elected president of both Crown Zellerbach Canada Ltd. and Elk Falls Co. Ltd. He replaces Paul E. Cooper, who resigned recently. Mr. Youngman will continue to serve as chairman of the boards of directors of both companies and also of Canadian Western Lumber Co.

In another Canadian change, Robert H. R. Young was elected to the newly created position of vice president and general manager of Crown Zellerbach Canada. He was formerly assistant vice president for manufacturing at the San Francisco headquarters of the parent firm.

In the United States, Reed O. Hunt, vice president of manfacturing, steps up to the newly created position of vice president for operation of CZ. He will have broad responsibilities for the over-all direction, planning and coordination of all the company's manufacturing and converting operations.

Sinclair Succeeds Hunt

Peter T. Sinclair, vice president for industrial relations, succeeds Mr. Hunt as vice president of manufacturing. He will direct production in the U. S. manufacturing and converting divisions.

E. A. Paul, general personnel supervisor, becomes director of industrial relations under Vice President Alexander R. Heron. He assumes Mr. Sinclair's former responsibilities for personnel administration, labor relations, employee relations, safety and specialized personnel placement.

E. W. Erickson, assistant vice president for manufacturing, assumes expanded responsibilities for over-all supervision of construction and project engineering, including the central engineering office. In addition, he will continue his other manufacturing responsibilities in such fields as pulp operations.

Herbert H. Wymore, resident manager at Carthage, N. Y., moves to CZ headquarters as assistant to the vice president of manufacturing and assumes Mr. Young's responsibilities for supervising converting operations.

Edward H. Nunn, assistant resident manager at West Linn, Ore., replaces Mr. Wymore as Carthage resident manager. Replacing Mr. Nunn at West Linn is Glen D. King, West Linn technical supervisor. He in turn has been succeeded by Peter T. Dickie, assistant technical supervisor.

Ray Dahl, project engineer at St. Helens Pulp & Paper Co. in St. Helens, Ore., has been made assistant manager in addition to his present duties.

Gus Ostenson, manager of paper production at Camas, Wash., has been named resident manager of the projected CZ kraft paper mill at Antioch, Cal. The plant is scheduled to begin production next year.

J. C. Davidson

R. I. Clark

Restigouche Promotes Two

According to an announcement from Restigouche Co. Ltd., J. Colin Davidson has been named assistant superintendent of the pulpwood division, and Robert I. Clark has been appointed divisional forester.

Both men are graduates of the School of Forestry of the University of New Brunswick. Upon graduation each joined the forestry division of Fraser Companies Ltd. at Edmunston, N. B. In 1952 Mr. Davidson was named divisional forester for the subsidiary firm, Restigouche Co. at Athoville, the position he held prior to his present appointment. Mr. Clark succeeds Mr. Davidson as divisional forester.

I.P. Co. Promotes Rand

The appointment of George H. Rand as divisional manager for the Northern Mills of International Paper Co. has been announced by Stuart E. Kay, vice president. He replaces the late W. D. Maxim, who died in Glens Falls, N. Y., November 21.

An alumnus of Bowdoin College and the University of Maine's pulp and paper curriculum, Mr. Rand joined International in 1930 at the Otis mill. In 1946 he was transferred to Niagara Falls as assistant manager and in 1952 was made assistant divisional manager of the Northern Mills.

Mills under Mr. Rand's supervision include those at Livermore Falls, Maine, and Niagara Falls, Tonawanda, Ticonderoga and Corinth, N. Y. He is a member of Tappi.

In another International appointment, J. E. McCaffrey was elected a vice president. Mr. McCaffrey is assistant general manager in charge of woodlands operations for the Southern Kraft Div. He was formerly division superintendent of the Woodlands Department at Georgetown, S. C., and was assigned to his present position in July 1954.

G. H. Rand

M. W. Swaim

Marvin W. Swaim, first vice president and general manager of Alton Box Board Co. of Alton, Ill., has been elected to the board of directors of the National Association of Manufacturers. He has been with the Alton firm for 27 years and has held his present position since 1944.

Names in the News . . .

Mr. Swain recently completed his third consecutive term as president of the National Paperboard Association.

Cass Resigns at West Virginia

A career of more than 50 years with West Virginia Pulp & Paper Co. was brought to a close recently with the resignation of Charles A. Cass from the board of directors. He is 74.

In accepting Mr. Cass' resignation, the board adopted a resolution paying tribute to his long service with the company and presented an embossed copy to the retiring director.

Mr. Cass was an active employee of the firm from 1902 until 1947, when he retired as secretary, a post he had held 38 years. He had served as a director since 1927. His father, the late Joseph K. Cass, was an owner of Morrison, Bare & Cass Paper Co. in Tyrone, Pa., until its sale to West Virginia in 1891.

Vernon H. Emory was recently appointed manager of manufacturing, pulp and paperboard for Fraser Companies Ltd. and its subsidiary, Restigouche Co. Ltd. Prior to this appointment he was manager of the Edmundston, N. B. mills. Mr. Emory joined Fraser Paper in 1930 and became manager in 1941.

V. H. Emory

J. A. Extrom

J. Alden Extrom has been named general manager of the paper mill of Chase Bag Co. at Chagrin Falls, Ohio. He was recently technical superintendent for Alton Box Board Co. at Alton, Ill. Mr. Extrom was at one time a paper consultant to Charles T. Main Inc.

Tom Boylan has been named manager of the three-state Atlanta, Ga. district office of American Forest Products Industries Inc. He succeeds Edward L. DeMotte, who resigned recently to assume duties as advertising director of an Atlanta lumber firm.

J. Daniel Bowden has been appointed director of Scott Paper Co.'s newly created Product Development Department. A 17-year veteran with the firm, Mr. Bowden was formerly director of marketing research. Succeeding him in this post will be **Gordon A. Hughes**, director of the Market Analysis Department for General Mills Inc.

Carlton W. Campshure has been named assistant superintendent of Appleton Coated Paper Co. of Appleton, Wis. He has been with the firm since 1930.

James M. Fallon recently completed 50 years of continuous service with the Beveridge Paper Co. of Indianapolis. He began his career as a cutter boy in 1904, became a machine tender in 1906, a superintendent in 1927, and is still active as general superintendent.

Stebbins Linings...

Important in Chlorine Dioxide Bleaching

Approximately 90% of the pulp bleached with chlorine dioxide in plants now operating or under construction will be processed in equipment lined by Stebbins.

Stebbins-lined chlorine dioxide reactors, generators, absorbers, storage tanks and bleach towers, including the very first installation, are giving excellent service.

The pulp industry can depend on Stebbins' experience, research, engineering and construction know-how to meet the requirements of new processes.

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SINCE 1884

Specialists in Design, Installation and Servicing of Linings and Tile Tanks

Fred A. Manske has been elected to the newly created position of executive vice president of National Gypsum Co. He will be in charge of the firm's production, operations and sales. He was formerly vice president in charge of operations.

Robert B. Moffitt, assistant chief consumers representative for Marinette Paper Co. at Marinette, Wis., has been named to a similar post at Scott Paper Co.'s Cut-Rite plant at Sandusky, Ohio. He has been a member of the Scott organization since 1949.

Donald A. (Pat) Moran has resigned as resident manager of St. Regis Paper Co.'s mill at Deferiet, N. Y. He will continue as a consultant on the staff of W. R. Adams, vice president in charge of manufacturing, until April 1, 1955. Mr. Moran joined the firm in 1950.

Robert A. Schnaars, division paper mill engineer at Marinette Paper Co. in Marinette, Wis., has been transferred to the Scott Paper Co. plant in Chester, Pa., as paper mill engineer. Mr. Schnaars joined the company in 1949 as an engineering trainee at Chester.

William Thom has been named woodlands manager for Longlac Pulp & Paper Co. Ltd. at Terrace Bay, Ont. He was formerly assistant woodlands manager for Spruce Falls Power & Paper Co. Ltd. at Kapuskasing.

Fred Haselow, for the past two years power superintendent, has been named chief engineer for Charmin Paper Mills Inc. in Green Bay, Wis. He joined the firm in 1946.

John W. Howard, 80, has retired after 47 years' service in the beater room of the Brewer, Maine mill of Eastern Corp. He was beater engineer 30 years.

George Nelson, director of safety for Consolidated Water Power & Paper Co., has been named vice president in charge of services for the Wisconsin Council of Safety.

Henry Fowler has been appointed general plant manager of Nicolet Paper Co. of West DePere, Wis., to succeed the late Bert Lewis. Mr. Fowler has been with the firm since 1932, when he joined the supercalender department. For the past two years he has been assistant manager.

NECROLOGY

William F. Christopher

William F. Christopher, 67, an official of paper mills in northern New York and Canada prior to his retirement some years ago, died November 8 in Clayton, N. Y.

Mr. Christopher was at one time superintendent of Remington Paper Mills in Raymondville, N. Y., later becoming general superintendent of all Remington properties in the area. He then became associated with Hearst Publishing Co. in New York, N. Y., where he was in charge of paper purchases and contacted mills in eastern Canada and the United States. At the time of his retirement, he was associated with Anglo-Canadian Paper Co. Ltd.

(Turn to Page 1036)

"From ingot to fourdrinier wire"

ANNEALING THE WIRES

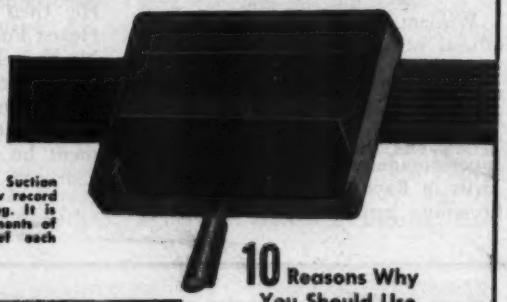
Just as one alloy differs from another, so do their individual requirements for annealling vary. A definite ratio of speed and temperature must be used for each type. Skilled employees, tending our modern annealling furnaces, adhere faithfully to the proper speed-heat formulae so that your Eastwood wire will have the longest possible life.

Because the Eastwood-Nealley plant is a *completely integrated* one, every wire we ship has undergone thorough and continual analysis, control and testing from the raw metals to your finished fourdrinier wire ready for quality paper production.

We are proud to say they are truly ours—"from ingot to fourdrinier wire".

EASTWOOD-NEALLEY CORPORATION
Belleville, N. J.

RES-LIN wire saver SUCTION BOX COVERS are PROVEN by TEST



PROVEN BY TEST, this RES-LIN Suction Box Cover is establishing a new record for longer life and even wearing. It is engineered to meet the requirements of specific production problems of each particular paper machine.

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10. No other can offer as even-wearing and wax-like surface as Reslin.

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for . . . PERFECT PERFORMANCE their is none better!

Expertly made with finest precision equipment from exrta select wire. Backed by years and years of experience is your assurance of the very best.

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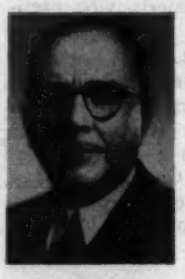
Necrology . . .

William D. Maxim



W. D. Maxim

William D. Maxim, manager of Northern Mills for International Paper Co. and president of Indian River Power Co., died November 21 in Glens Falls, N. Y.

Mr. Maxim's association with International covered a period of more than 45 years, during which time he played a major role in the firm's expansion program. He had traveled extensively in both the United States and Canada and had a close acquaintance with the paper industry and its allied operations.

As division manager, he maintained offices in Glens Falls and Corinth. Mills under his supervision included those at Livermore Falls, Maine, and Ticonderoga, Corinth, Niagara Falls and Tonawanda, N.Y.

Ameil Umberham, 62, former safety director for Northern Paper Mills in Green Bay, Wis., was accidentally burned to death December 8. In 1920, Mr. Umberham managed the famed Northern basketball team which won the Central AAU title.

George J. Bernard Sr., former vice president of B. F. Perkins & Son Inc., died recently in Northampton, Mass. Mr. Bernard retired in 1953 to become board chairman and treasurer of Magnat Machinery & Patent Co.

Ledyard Cogswell Jr., 76, chairman of the board of A. P. W. Products Co. Inc. of Albany, N. Y., died at his home recently.

Mrs. Lucinda D. Kindleberger, 79, widow of the late founder of Kalamazoo Vegetable Parchment Co., Jacob Kindleberger, died November 17 in Kalamazoo. Her son, Joseph, a vice president of KVP, died in 1952.

Edward A. Edmonds, 86, a former manager of Falls Paper & Power Co. in Oconto Falls, Wis., died recently in San Diego, Cal., where he had resided since 1913. At 24 Mr. Edmonds was a member of the Wisconsin state legislature.

SAFETY NEWS

CONGRATULATIONS are in order on completion of 10 years without a lost-time or disabling accident in the catalog paper finishing room of Fraser Paper Ltd. Aubrey Crabtree (r), president of the firm, makes a special award to William Beek, foreman

10-Year Record at Fraser

A record of 10 years without a lost-time or disabling accident has been achieved by the catalog paper finishing room of Fraser Paper Ltd. in Madawaska, Maine. A recent celebration marked the accomplishment.

During the program, Aubrey Crabtree, president of the firm, declared, "Your outstanding record of 10 years without a disabling or lost-time accident is one of which you and the company can be justifiably proud." Accidents create untold hardships, he continued, expressing the hope that the men would sustain the record for at least another decade.

Awards of various kinds were made to the 23 men who presently staff the department. More than half of them have been in the finishing room for more than 10 years. A special presentation was made to William Beek, department foreman.

Marathon Plant Celebrates 1,000,000 Safe Man-Hours

For the second time the paper converting plant of Marathon Corp. in Wausau, Wis., has achieved 1,000,000 consecutive man-hours without a lost-time injury. The plant thus becomes the first Marathon division to reach the goal more than once.

At a special celebration of the plant's record, the challenge was given to extend the operation's current record of nearly 1,127,000 safe man-hours to 2,000,000. This would mean a new world's record for paper converting plants. The all-time high is 1,830,000 accident-free man-hours. It is held by a Philadelphia plant of Container Corp. of America.

In a short talk during the ceremonies, D. C. Everest, chairman of the board of Marathon, declared, "I have long been a crank on this safety business because I have seen the terrible suffering and losses that come from accidents. Through personal experience, I know how important accident-prevention is."

Working Together

Following Mr. Everest's talk, A. E. Stanke said that it is hard to put a finger on the specific "How" behind the record. Mr. Stanke, who is safety coordinator for the Wausau Div., declared, "More than anything else I believe it is simply the knack of working together to reach an important goal. The three C's have been and will continue to be our guide: Courtesy, Caution, Common Sense."

Highlight of the program was the presentation of an engraved plaque to Oscar O. Eggebrecht, manager of the division. The award — the second such trophy merited by the local plant — was made by Fred W. Braun, vice president of accident prevention for Employers Mutuals of Wausau. In accepting the honor, Mr. Eggebrecht reminded those present that, "safety is something that must be on our minds at all times — not just at work, but also at home, while driving on the road, while hunting and fishing, during every phase of human activity."

Safety News Notes . . .

The Paper and Pulp Safety Standards Committee will meet January 27 for consideration of the PI Safety Code. The gathering will be at the American Standards Association, 70 East 45th St., New York, N. Y. Chairman of the group is Harley B. Goodrich of Strathmore Paper Co. in West Springfield, Mass.

On October 5 Sorg Paper Co. of Middletown, Ohio, completed 1,000,000 man-hours without a lost-time accident. In establishing the record — the best in the firm's history — the plant has had no lost-time accident since December 14, 1953.

Past Accomplishments Challenge the Future . . .

"We have reduced injuries 50 per cent in our plants in the last 10 years and can be proud of this accomplishment. This record is more impressive when we consider that only two other industries (construction and chemical) have more units reporting to the National Safety Council.

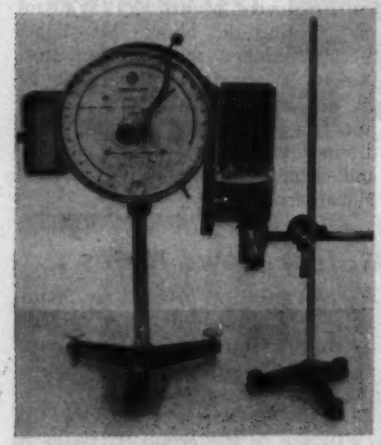
"As good as our record is, we cannot afford to let up in the battle against injuries. No Safety Man worth his salt will ever rest as long as his operations produce even one first aid case. As one outstanding safety director put it: 'It is our duty to work ourselves out of a job by eliminating all injuries.'

"Every member of the executive committee of the Pulp and Paper Section, by accepting his place on the committee, has pledged himself to give extra time to the preparation of data sheets, safety instruction cards, engineering studies and all other work of the executive committee. Let us roll up our sleeves and complete all projects in process and start new ones. We can reduce our injury rate another 50 per cent in much less than 10 years by pooling our efforts and sharing our experiences."

(Signed) Dallas E. Henry
General Chairman
Pulp and Paper Section
National Safety Council

(This letter was written to members of the NSC's Pulp and Paper Section. It appeared in the December issue of the section's "Safety News Letter." Mr. Henry is safety coordinator for Southern Advance Bag & Paper Co. at Hodge, La.)

FOREIGN ABSTRACTS



Studies on machine-coated papers

Various difficulties encountered in offset printing are reviewed very briefly. The body of the article gives a brief report, emanating from the Research Institute for Graphic Arts, in Amsterdam, Holland, on a method for determining the lowering of the surface tension of water that has been brought into contact with machine-coated papers containing surface active agents. Such lowering would cause a more satisfactory moistening of the paper which is to be printed by offset.

Strips of paper (5 × 5 cm.) are placed in 50 cc. water and the surface tension measured within 10, 20 and 30 sec. at room temperature, and the decrease in surface tension over that of water is computed. The apparatus, which consists of a torsion balance indicating in milligrams the weight required to detach the edge of a thin platelet from the surface of the water, is shown in the accompanying figure. The results are computed in dynes/cm.

The author shows the marked differences in various machine-coated papers in a table. F. J. M. Wijnekus. *Allgem. Papier-Rundschau,* No. 21, (1954) 1040-2 (in German).

Semichemical pulps from wheat straw

Two general procedures are used. In the first part of the article, the method of Bertrand and Delga (*Compt. rend.*, 220, 805 [1945]) is adapted to large scale laboratory experiments, in which the author treats 70 kg. of straw with 20 kg. of lime in 3000 l. of water. About 3 kg. of calcium oxide are added at the start, and subsequent additions are made every 15 min., using 0.5 kg. at each addition. The temperature is maintained at 40° C. and the entire maceration period is 24 hrs. The procedure gives a poor pulp, hence the operation is modified by treating with 30 kg. of lime, adding 3 kg. at the start and 0.5 kg. every 15 min. during the first 4 hrs., after which similar additions are made every ½ hr., with thorough stirring. The total period of maceration is 32 hrs. The washed pulp is treated in a kollergang, then put through a Lamort disintegrator screen, thus giving 50.5 per cent of utilizable paper pulp and about 25 per cent screenings. The pulp produced in this way retains 15.7 per cent lignin. A by-product is calcium acetate, which, in terms of acetic acid, amounts to about 3 per cent of the weight of the straw. Papers made from these pulps show physical properties quite similar to those obtained by Bertrand and Delga and approach those of papers made from a commercial straw pulp.

In the second part, the author describes experiments in which straw (freed from leaves, spikes and nodes) is treated under varying conditions with cold caustic soda. A satisfactory pulp is obtained by a 16-hr. treatment at room temperature, *without* stirring with 2 per cent NaOH (using 24 g. of caustic soda per 100 g. of straw) and a liquor to fiber ratio of 12 to 1. At the end of the steeping period, and prior to washing, the fibers are kollerganged 20 min. in the presence of black liquor. The resulting pulp is high in pentosans, contains 13.5 per cent lignin, and is unsuited to bleaching. The yield is about 65 per cent, with about 3.7 per cent screenings; and the physical properties of this semichemical pulp are similar to those of chemical straw pulps. Various modifications of the procedure are outlined and full data are given in a series of tables. J. Francais. *Assoc. tech. ind. papetiere, Bull.*, 1954, No. 3, 93-99 and 125-133. (in French).

Opacity changes in beaten and purified pulp

The authors give a critical review of the literature with 45 references, followed by definitions (in mathematical terms) of the contrast ratio, printing opacity, scattering power and scattering coefficient.

An unbleached Mitscherlich pulp is purified by various alkaline treatments and then beaten to various degrees Schopper-Riegler, and the changes in opacity are determined. During the beating operation, the scattering coefficient of the original pulp decreases in three stages. At first there is a rapid drop in scattering coefficient, then follows a much slower decrease and finally another more rapid drop.

When the pulp is *not* beaten but given cold or hot alkaline treatments which cause removal of hemicelluloses, the scattering coefficient rises, the maximum rise occurring when 10 per cent caustic soda is used in the purification. On *beating,* these purified pulps show marked differences in behavior, depending on the treatment they receive prior to beating. When the purification is slight, the scattering coefficient is low; when high alpha celluloses are reached in the alkaline treatments, the scattering coefficient is considerably higher. On cold purification with 10-15 per cent caustic soda, the scattering coefficient actually rises during the beating process, but after hot alkaline treatments, the scattering coefficient falls with time of beating. However, in the hot treatments the opacity also increases with decreasing hemicellulose content.

Opacity measurements are not always well correlated with transparency data, but the former measurements are presumably the more reliable. The authors suggest that in testing pulp sheets, it would be well to include opacity measurements to precede the strength tests. G. Jayme and H. Pommer. *Das Papier,* 8, 259-68 (1954) (in German).

Possible pulpwoods from Kenya

Three logs of the wood of *Neoboutonia* (I), *Macaranga* (II) and *Croton* (III) are studied from the standpoint of pulping properties. The samples were barked prior to their receipt. The sulfite process is shown to be unsatisfactory, so kraft pulping is resorted to. *Neoboutonia* and *Croton,* when given alkaline cooks, give pulps of moderate strength, which are probably suited to writing or printing papers after bleaching, but which can not be used in wrappings. The strength of pulp from *Macaranga* is poor.

A mixed kraft pulp made from 40 per cent *Neoboutonia,* 20 per cent *Macaranga,* and 40 per cent *Croton* can be bleached satisfactorily by multi-stage bleaching, and after beating achieves moderate strength. This bleached material may be satisfactory for incorporation into printing and writing papers but presumably would require the addition of longer fibered pulp to impart sufficient strength. A. E. Chittenden, C. G. Jarman, D. Morton, and G. B. Pickering. *Colonial Plant and Animal Products* (London), No. 1, 46-52 (1954), with 2 plates; through *Bull. Inst. Paper Chemistry,* 25, 22 [1954]).

Isolation of eucalyptus lignin by means of alcoholysis

This is the twelfth paper in a series on the chemistry of Eucalyptus lignins. Lignin fractions are isolated from *Eucalyptus regnans* wood, by treating with ethanolic or methanolic solutions of hydrogen chloride in the absence of air (under ni-

trogen). The various fractions are fully described and their empirical composition and groups are given.

"Ethanol lignin A," prepared in the *absence* of air, is different from a similar fraction isolated in the *presence* of air; but on long storage, "Ethanol lignin A" changes gradually and finally shows a composition resembling that of the similar fraction prepared in the presence of air. "Methanol lignin A" shows certain fundamental differences from "Ethanol lignin A".

The properties of these various fractions and their derivatives are discussed fully, and analytical data are given in a series of tables. One interesting fraction, isolated from the filtrate and washings in the preparation of "Ethanol lignin A," appears to be an ethanol-lignin complex. J.W.T. Merewether. *Holzforschung*, 8, No. 4, 116-23 (1954) (in English).

Clamping area; its effect on the burst factor

Referring to his previous studies on relationship between tensile strength and burst, the author has now developed a formula in which he relates the area of clamping to the bursting strength. The construction and the operation of two bursting strength testers are carefully analyzed. These are the Schopper-Dalen apparatus, which has a clamping area of 10 or 100 sq. cm., and the Mullen, in which the area is 7.3 sq. cm.

The author then develops conversion factors, the validity of which are demonstrated by experiment. Other factors that may influence the experimental results are also discussed. Seven figures and seven references are given. Wilfried Vollmer. *Das Papier*, 8, 371-6 (1954) (in German).

Importance of fines in characterization of dissolving pulps

By using a simplified Hillbom screen (that is fully described with an appropriate sketch), the author separates the fines sharply from various dissolving pulps. If such fines are used in attempted sheet formation, a dark, brittle horny mass results, which powders readily. When fines are removed from dissolving pulps, their quality improves greatly, inasmuch as many of the production difficulties in the viscose process can be traced back to the fines. On the other hand, in papermaking a certain percentage of the fines are beneficial and increase sheet strength.

In a series of spruce dissolving pulps, analyses are made, both of the separated fines and of the residual "clean stock." Yields of the fines vary from 4.6 per cent to 8 per cent; and, invariably, the copper numbers, extractives, lignin and ash are higher in the fines than in the stock freed from fines. On the other hand, the brightness of the fines and the alpha-cellulose content of the fines are lower than those of fine-free pulp.

In a number of hardwood dissolving pulps, the fines range from 5.6 per cent to 19.3 per cent, and the analytical data shows trends that are very similar to those given by the coniferous pulps. Full analytical data are given in all cases, and from the percentage of fines and the chemical analyses, the suitability of a dissolving pulp can be gaged. Five tables, 12 figures and 8 references are given. Paula Sarten. *Das Papier*, 8, 376-82 (1954) (in German).

Kraft bleached pulps from prehydrolyzed pinewood (in Poland)

Pine chips are heated with aqueous sulfuric acid for 2.5 hours at 130° C. and then subjected to the kraft process, using a liquor of 24.4 per cent sulfidity, a 4.5: 1 liquor-to-wood ratio and 22 per cent active chemical (as Na_2O) based on the dry wood. Bleaching of the pulp is varied with respect to bleaching period, chlorine used, and pH of the hyprochlorite solution (buffering with NaOH). In general, the pulp can be bleached readily and shows less degradation than the normal kraft pulp.

A satisfactory bleaching process (to achieve 85 per cent Pulfrich photometer brightness) involves four stages, including two hypochlorite stages. Although this same per cent of brightness can be attained in three stages, the four-stage process demands less chlorine. In the optimum bleaching operation, the total chlorine consumption is 5.5 per cent of the weight of the dry pulp. In the original chlorination stage, 68 per cent of the total chlorine is used at 20° C., acting for 3/4 hour. The second step involves the use of 1.2 per cent NaOH based on the pulp and requires 1 hour at 40°. The third step involves 22 per cent of the total chlorine (hypochlorite), using 1 per cent NaOH based on the pulp and requiring 2 hours at 38° (final pH 11.5). The final stage requires 10 per cent of the total chlorine and 1 per cent NaOH, 2 hours at 35°; the final pH is then 11.9.

The bleached pulp evidently has properties similar to those of Swedish "Cordicel" pulp. Its alpha content is about 94.5 per cent, and its brightness ranges from 85-87 per cent. The yield based on the original (unhydrolyzed) wood is 31 per cent and on the prehydrolyzed wood basis is 38 per cent. Wlodzimierz Surewicz. *Prace Inst. Celluloz-Papier*, 3, 24-33 (1954) (original in Polish) (through *C.A.*, 48, 14198-9).

Tests used in the selection of paper machine operators

In a Finnish paper mill, a test was given to 36 men working on paper machines to determine whether psychological adaptability tests could be applied in the selection of paper machine operators. A control was based on the reports given by foremen and engineers regarding these men, and the correlation coefficient with the test results was considered very satisfactory. The benefits from giving such tests are discussed. Niilo Ryti. *Paper and Timber* (Finland), 36, No. 6, 275-8 (1954); through *B.I.P.C.*, 24, 952 (original in Finnish, with English summary).

Star Performers on Important Duties

Aurora Non-Clog Pumps, both Vertical and Horizontal have won high favor

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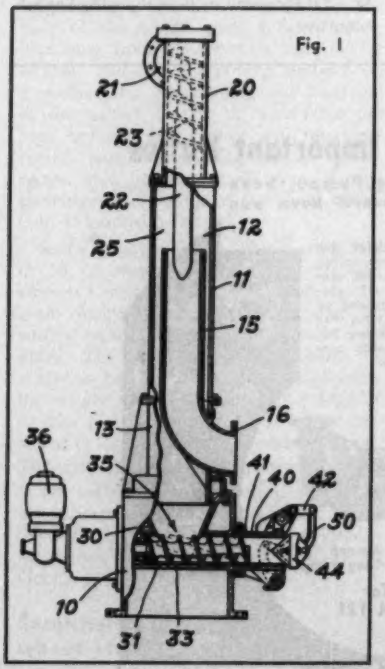
PATENT REVIEWS

MELVIN NORD*

Grit separator

U. S. 2,681,610, issued June 22, 1954, to Raymond L. Schrock and assigned to the Black-Clawson Co., relates to apparatus for separating grit and other solid particles from a liquid suspension such as papermaking stock. It has in the past been common practice to remove the separated reject material by continuously or intermittently bleeding off a small quantity of liquid from the separating apparatus at a point where the separated reject material collects in the apparatus; but in such operations it then becomes necessary either to conduct the resulting mixture of liquid and reject to the sewer, or else to concentrate it by a further straining or drying treatment. In either case, the liquid lost with the reject material or the further concentrating treatment add undesirably to the cost of the separating operation and correspondingly reduce efficiency.

Fig. 1



Improved results from the standpoint of simplicity, convenience and economy have been obtained by equipping cleaning and separating apparatus of the type with a continuously operating reject-removing conveyor screw mounted in a tube having a closure door counterbalanced to a normally closed position. In operation, the conveyor screw collects and compacts the reject material into the form of a relatively solid slug between the end of the screw and the closure door, and then as additional reject accumulates and is forced against this slug, the door will be opened against its counterbalance to effect gradual discharge of the reject, in the form of a damp sludge roughly comparable in consistency to sand and readily handled for disposal by a shovel. During this discharging action, however, a substantial slug of reject material remains between the end of the screw and the opened door and acts effectively as a seal against free discharge.

*Patent attorney, 17600 Pinehurst, Detroit 21

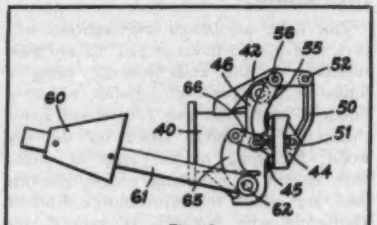


Fig. 2

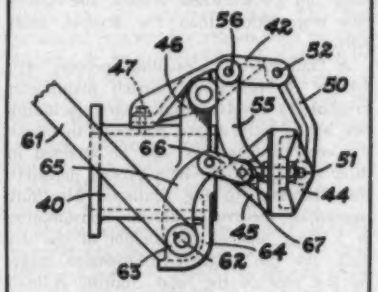


Fig. 3

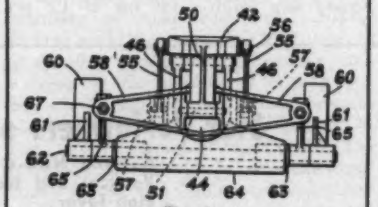


Fig. 4

The apparatus is shown in Figs. 1-4, Fig. 2 showing a side elevation of the door in a closed position and Fig. 3 in open position, and Fig. 4 being a front view of the door. The drawings show a vortex separator, which includes a main base 10 supporting a cylindrical casing 11 enclosing a separating chamber 12. A center section 13 is positioned between the casing 11 and base 10 to form an extension of chamber 12, and it includes an outlet conduit 15 which projects upward in chamber 12 and is curved for attachment at 16 to a discharge pipe. An inlet conduit 20 is mounted on the upper end of casing 11, and it includes a tangentially arranged inlet connection 21 at its upper end. A helix is mounted in the inlet conduit 20.

The adjacent ends of the inlet and outlet conduits 15 and 20 are spaced axially to provide an annular gap 25; and in operation, the stock entering the apparatus is provided with a whirling motion by the tangential arrangement of the inlet connection 21 and the helical vane 23 before it reaches the chamber 12. The centrifugal force resulting from this whirling motion causes heavy particles in the stock to be thrown radially through the discharge passage or gap as the clean stock flows across this gap into the upper end of the outlet conduit 15. These discharged heavy particles will also whirl in a larger spiral as they are discharged into the outer part of the chamber 12 and as they settle towards the bottom of the chamber.

The base 10 includes a tapered throat portion 30, which forms the bottom of the separating chamber 12, and a cylindrical passage 31 extends horizontally through the base below this tapered throat 30, the passage 31 being lined with a cylindrical sleeve 33 which is cut away in alignment with throat 30. Within the sleeve 33 is a conveyor screw 35 which is connected with a drive motor 36 mounted at the back of the base, with the screw thus being effective to force the solid particles settling from the separating chamber 12 through the throat 30.

This conveyor unit is provided with an outlet door unit which includes a main casting 40 bolted to the base 10 at 41. A bracket 42 is mounted on top of casting 40 and forms the support for the closure door plate 44, which has a conical nose piece 45 arranged to fit and seal the outer end of sleeve 33 in the closed position of the door.

In the closed position of the door shown in Fig. 2, the counterweight arms 61 extend in nearly horizontal direction so that the effective counterbalancing action of the weights 60 will be near a maximum, whereas in the open position of the door shown in Fig. 3, the counterweight arms 61 extend upwardly at a substantial angle to the horizontal, producing corresponding shortening of their effective length with resulting decrease in the counterbalancing load. Thus, in the closed position of the door, there is high counterbalancing force exerted in the direction to hold the door closed, but as the door opens this counterbalancing force is decreased.

When a slug of the desired consistency has been formed, then as additional reject accumulates and is forced against the inner end of the slug, the door 44 will be opened against the action of its counterweights, and the reject material will be gradually extruded through the resulting opening, with the rate of discharge corresponding to the rate which reject accumulates and hence at approximately the same rate as that at which re-

ject material is separated from the stock passing through the separating chamber 12. At the same time, the slug of reject remaining in and moving through the end of the sleeve 33 will effectively seal against free discharge, and since in the accumulation of the reject slug the water will be effectively squeezed out and back into the body of the device, the material as discharged is in the form of a damp sludge.

The construction and mounting of the closure door as shown provides for its straight line movement and also for the change in effective counterbalancing force as the door opens. The desired initial accumulation of the reject slug is readily effected without danger of leakage, but thereafter the door opens without unduly loading or straining the conveyor screw and its drive motor. The easy opening action of the door, and its reduced resistance to discharge after it is opened, combine to reduce the working load on the screw 35, and this is an important factor in reducing abrasive wear on the screw and hence in contributing to a longer useful life for all of the parts. The pointed formation of the door nose piece is also an aid to efficient and economical operation, since it acts to prevent unduly tight packing of the reject and to distribute the force evenly around the door for easy opening at the proper moment.

Disintegrator for fibrous materials

U. S. 2,674,927, issued April 13, 1954 to Sture V. Wicksell, refers to an apparatus for disintegrating fibrous materials such as pulp bundles or paper waste in water. In this invention, the rotor, the pump wheel, and the strainer plate are built together to form a rotating unit.

The apparatus is shown in Figs. 5 and 6. The rotor 1 is arranged at the bottom of a receptacle 2, which is to be filled with the material to be disintegrated and with water in a proportion of 3.5 to 5 per cent of pulp. Arranged in the hub portion of the rotor are a number of vanes 3 adapted to bring the pulp into rotation while working on the pulp and facilitating its disintegration. The bottom of the container is inclined

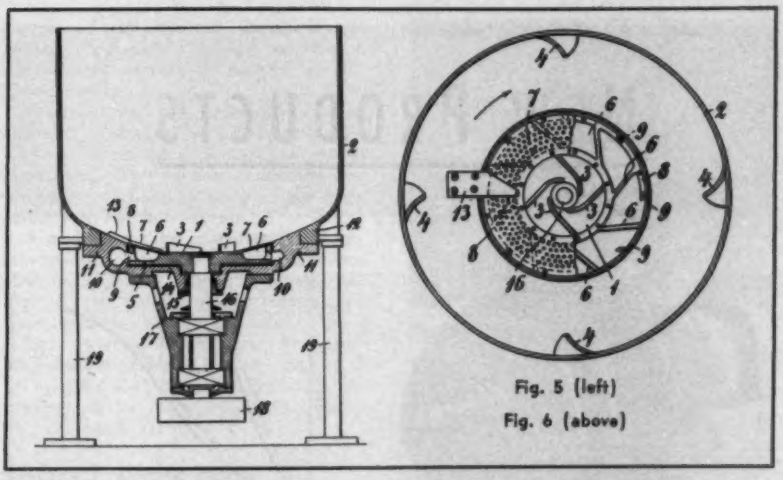


Fig. 5 (left)
Fig. 6 (above)

and consequently brings about a vertical circulation of the pulp, guide plates 4 arranged on the cylindrical wall of the container then effecting a deflection of the stream of pulp inwardly toward the center of the container, where the pulp flows downward. Extending from the rotor hub is a plane disk 5 forming an attachment for a number of pump wheel vanes 6, which are covered at the top by a strainer plate 7. A radial outlet from the pump opens between the short vanes 9 into a spiral-shaped channel 10 in a pump housing 11. Screwed onto the part of the pump housing 11 located on a level with the bottom of the container is a scraper 13 extending over the strainer plate and preventing the fibrous pulp from sticking to the plate.

The bottom portion 14 of the pump housing is tightened against the rotor shaft 16 by a stuffing box 15, and formed as an attachment for a bearing housing 17 arranged underneath the pump housing. The rotor shaft 16 carries at its lower end a belt pulley 18, through which the rotor is connected to a driving motor, not shown in the drawings.

When the vanes 3 throw the mixture of water and pulp over the strainer plate 7, the liberated fibres will be separated to pass through the holes of the strainer plate and to be caught by the vanes 6, 9, the mixture of fibers and water being thus hurled out into the channel 10 in the pump housing, whence it is emptied into a collecting receptacle, or is returned to the pulp container 2 to be subjected to repeated treatment. Through the arrangement of the strainer plate 7 immediately outside the vanes 3, and through the rotary movement of the strainer plate, the latter will powerfully act upon the pulp of fibres in order to actuate disintegration.

Other Patents of Interest to the Paper Industry

Subject	Inventor or Assignee	Patent No.	Date
Corrugated paper machine	Packaging Materials Corp.	2,680,996	6/15/54
Apparatus for continuous chemical cleaning and conditioning of paper mill wet felts	Dudley A. Huber	2,680,997	"
Dome top carrier carton	Waldorf Paper Products Co.	2,681,148	"
Tray structure	Waldorf Paper Products Co.	2,681,173	"
Hollow wall box	Robert M. Borgstein	2,681,174	"
Double window envelope	Andrew M. David	2,681,175	"

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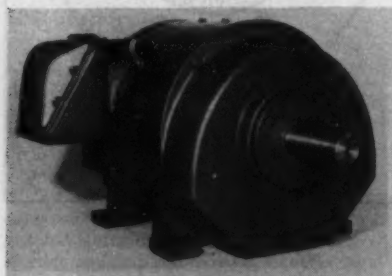
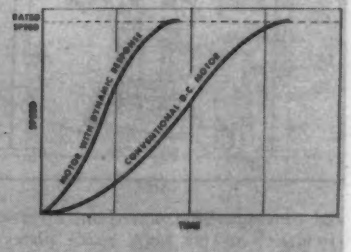
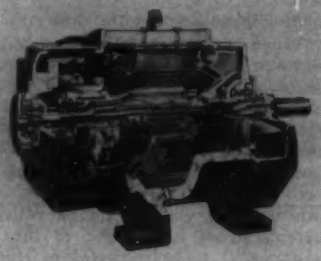
NEW PRODUCTS



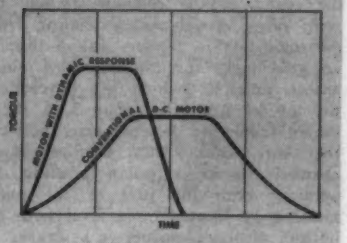
NEW TOTALLY-PROTECTED
RELIANCE SUPER "T" LINE D-C. MOTOR



COMPARISON OF ABILITY TO ACCELERATE
RELIANCE SUPER "T" LINE VERSUS CONVENTIONAL MOTOR



CUTAWAY OF
NEW RELIANCE SUPER "T" LINE D-C. MOTOR



COMPARISON OF AVAILABLE TORQUE
RELIANCE SUPER "T" LINE VERSUS CONVENTIONAL MOTOR

Direct-current motors

A complete new line of industrial direct-current motors has been introduced to industry. It is known as the "Super "T" " line.

These new motors employ the new concept of "Dynamic Response," formerly found only in specially designed machines. They are described as producing the fastest and most accurate response ever offered in a standard design motor.

"Super "T" " design features include ruggedness, ability to take full load and overload, ability to change speed rapidly, ability to maintain torque and tension, and reverse and stop quickly.

According to the manufacturer, the time required for these motors to accelerate to full speed has been cut to half the time that was formerly required. Lower mechanical inertia, lower electrical inertia and higher commutating ability have been combined in this motor.

This new line of motors is being produced in sizes from 20 to 100 hp, and the range will be extended both upward and downward to higher and lower horsepowers. A complete range of mechanical enclosures has been developed. *Reliance Electric & Engineering Co.*, 1088 *Ivanhoe Rd., Cleveland* 10, *Ohio.*

Vapor-pressure actuated thermometer system

Vapor-pressure actuated thermometer systems which record on uniform charts, instead of the expanded charts previously necessary, are now available. According to the manufacturer, the new thermometers combine the advantages of freedom from ambient temperature effects, fast response, high torque, small bulb size, and extra sensitivity of the vapor-pressure systems with the linear scale, uniform graduations, and simple control attachments used with gas or liquid filled systems.

A patented varying-ratio linkage converts the non-linear vapor pressure-temperature curve into a linear deflection of the recording pen. The linkage is available for all ranges from −20 to 600° F. For cross ambient ranges, a dual-filled system with uniform scale is used to replace more expensive fully compensated Class 1 thermometers. Dual filled, linear systems are used for ranges under 200° F.

The linear Class 2 thermometers are said to be ideal for partial range and short-span automatic controllers because of their large torque and high-speed response. *Bristol Co., Waterbury* 20, *Conn.*

Roll wrapping machine

The "Spirolwrap" is a new machine which mechanically wraps rolls of paper with a spiral wrapping and applies and crimps endbands. The manufacturer claims that the machine has the following advantages: tight multi-ply protection and uniform tension; full roll-edge protection through mechanical endband crimping; automatic gluing of spiral wrap as it is wound onto the roll; gluing of end wraps (optional); fewer damaged rolls; no mechanical adjustment is necessary to handle rolls of varying sizes; easy roll loading and power-operated roll ejection; easy inside heading; simple one-station control panel; one width wrapper for all length rolls; reduction in wrapper cost and inventory; use of roll butts and machine fills made possible; less power required, and less waste per shipped roll.

Inside heads may be inserted before or as the ends are crimped. Separate adjustable tension controls are furnished for the end wraps and the spiral wrap material. The machine is equipped to operate at threading or running speed and sequence of operations are protectively interlocked.

The "Spirolwrap" can wrap rolls of any length from 24 to 100 in., with diameters ranging from 24 to 60 in. It is designed for speeds up to 170 fpm. *Rice Barton Corp., Worcester* 1, *Mass.*

Lining system for water tanks

A new ceramic base material for protecting and restoring water tanks is part of a new lining system recently developed. The heart of this system is "Expansolin," a ceramic material with the ability to expand and contract with iron or steel to which it is bonded. The new system is said to be effective for protecting new tanks or for restoring old ones.

The ¼ in. protective layer realized with this water tank lining system will not crack or otherwise fail when subjected to variable temperatures from 34° to 230°F., it is claimed, nor will its effectiveness in preventing tank corrosion by commercially neutral water be impaired by extreme temperature fluctuation.

The manufacturer reports that this system results in a lining with excellent adhesion, complete inertness to hot or cold water, no chance of contaminating contents, resistance to sludge and lime build-up, increased heat exchange rates and good insulating value. *Emjay Maintenance Engineers,* 327 *Union Ave., Rutherford, N. J.*

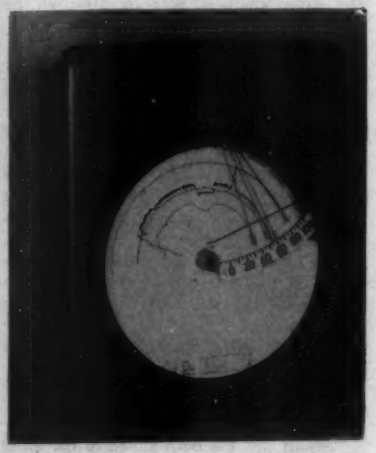
Stock refiner

A radically new type of stock refiner, developed in France and recently introduced to this country, is known as the "Alligator" refiner. This new refiner is said to be particularly outstanding with respect to fiber control and power economy.

Among the grades checked at the Black-Clawson laboratories were Southern bleached kraft, Northern bleached sulfite and sulfate, Western bleached kraft, Northern bleached hardwood kraft, soda pulp, etc. On these and many other grades the

efficiency of the "Alligator" as to freeness, mullen, tensile, tear and fold was well established, according to the manufacturer.

With respect to power, using these same named grades, in comparison with the power requirements of other refiners, the savings are said to be outstanding. *Shartle Div., Black-Clawson Co., Middletown, Ohio.*



Recorder

A new recorder now on the market is a receiver recorder for pneumatic and electric transmission systems in power and process plants. It will record any measured variable which may be converted to pneumatic or electric signals, according to the manufacturer. Continuous, independent records of one to four pneumatic and electric transmissions in any combination are possible because of plug-in, precalibrated receivers.

Receiver units may be added or interchanged, permitting easy field adaptation to new or revised metering and control applications. Two plug-in escapement-type integrators may be included in the same casing with two flow records.

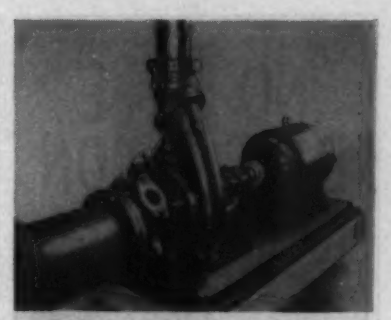
According to the manufacturer, fountain-type recording pens provide continuous feed for one year without refilling. The new pens are stainless steel capillaries, fed from hermetically-sealed ink sacs.

The recorder is designed for panel mounting, requiring a cutout only 14 x 17 in. Panel bolt holes and studs are not required. *Bailey Meter Co.*, 1050 *Ivanhoe Rd., Cleveland, Ohio.*

Soluble green IB paste

An improved paste type of soluble green IB has been announced. This dyestuff is said to overcome the printing problem present in the color shop due to poor print paste stability and relatively short storage life. Previously, print pastes containing soluble green IB paste stored over a weekend, for example, have often produced prints of poor quality, showing low tinctorial value due to regeneration of the parent vat dye.

According to the manufacturer, the new paste shows an excellent rate of fixation, as well as excellent working and fastness properties. *Arnold, Hoffman & Co., Inc., Providence, R. I.*



Paper stock pumps

A series of paper stock pumps with new features designed especially for easy maintenance is designated as Fig. 3135. The diagonally-split casing of these new pumps is hinged to provide quick and easy access to the rotating elements. Another special feature is a telescopic joint in the discharge connection. This makes it possible to open the casing without disturbing piping connections, it is claimed. It also serves as an expansion joint.

The vertical discharge is located in the highest point of the casing, so there is no possibility of air binding. Horizontal discharge can be obtained simply by rotating the discharge elbow 180°, according to the manufacturer. The vertical centerlines of both suction and discharge are the same, eliminating the need for right- and left-hand pumps, thus simplifying the layout of piping and minimizing spare parts inventory.

The entire liquid end of the Fig. 3135

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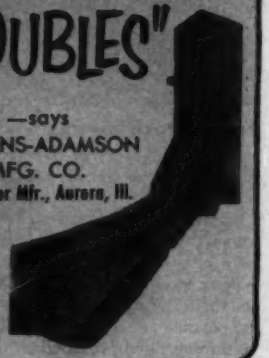

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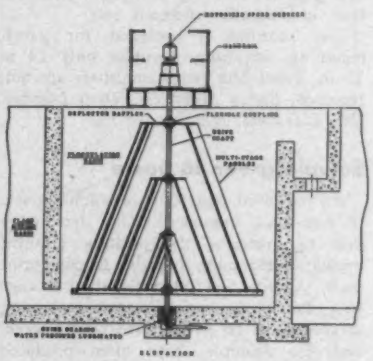

Flocculator

A new flocculator, designated as the Spirol-Mix flocculator, is designed for vertical mounting in the flocculation basin. Water entering at the bottom of the basin is gently roll-mixed as it passes upward through the basin to the outlet at the top.

The unit consists of a variable-speed drive mechanism mounted on top of the basin and directly connected by a flexible coupling to a paddle-type mixer assembly within the basin. The mixer assembly consists of a vertical drive shaft to which blade support arms are attached. Load and thrust of the entire assembly is taken up by thrust bearings in the drive mechanism. The drive shaft is held in place at the bottom of the basin by a pressure, water-lubricated guide bearing.

According to the manufacturer, this flocculator is the only unit that provides all three of the following important functions: (1) eliminates short-circuiting of flow which will waste chemicals and lengthen settling time; (2) provides a decreasing rate of agitation as floc forms while rising in the basin, thus preventing a break-up of floc already formed in the earlier stages, and (3) produces a uniform roll-mix action in the same direction as the water flow, providing an ideal environment for the formation of floc. *Graver Water Conditioning Co., 216 W. 14th St., New York 11, N. Y.*

Amorphous silica gel

"Syloid 72" has been added to the series of "Syloid" functional silica pigment products. The new product has the same general field of uses (including its use in paper coatings) as "Syloid 244", but differs physically. The new product has a particle size of 3 to 5 microns average and a considerably higher density, weighing 8.9 lb. per cu. ft. as shipped.

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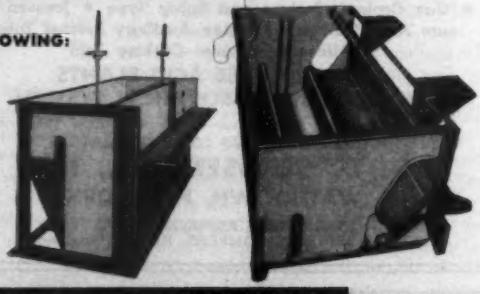
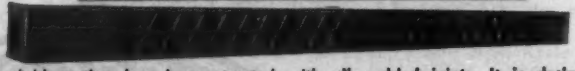


STAINLESS STEEL or MONEL SUCTION BOXES



This rigid suction box is constructed with all welded joints. It is designed to eliminate bowing or sagging giving maximum cover support. It has good depth and is easily cleaned. All supports inside of box are tapered to prevent stock build-up. Can be machined for any type of cover mounting. Furnished either in stainless steel or monel.

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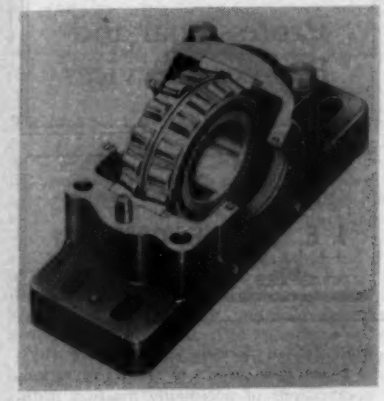
FABRICATORS

Because of the controlled low particle size and high whiteness values, "Syloid 72" is suggested for use in paper coatings. The softness of this amorphous silica gel is another feature to recommend its use in paper coatings. *Davison Chemical Co., Div. of W. R. Grace & Co., Baltimore* 3.



Roller bearing pillow blocks

The recently announced line of mill bearings has been augmented to include pillow blocks with heavy-duty self-aligning roller bearings for press fit on shafts. The new Series LPK7800F bearings have steel split housings. The rugged caps and bases are secured with four extra-heavy bolts and large dowels.

Press fit of bearings on machined shafts is said to assure positive concentric mounting, and locknut and lockwashers, positive location. With shafting machined as recommended, full capacity of the self-aligning, self-contained double row roller bearing is assured, according to the manufacturer.

Series LPK7800F mill bearings are available in bore size range of 3.1496 in. to 7.4803 in. *Link-Belt Co.,* 307 *N. Michigan Ave., Chicago* 1, *Ill.*

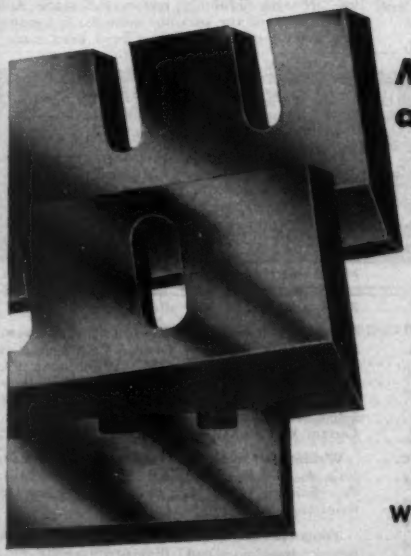
Combination side shifter and clamp

A new combination side shifter and clamp is now on the market. The unit is designed to handle rolls of paper ranging from 32 to 52 in. in diameter and weighing up to 3,000 lb. The rolls can be picked up in roll position and turned 90°, making it possible to stack them on end. The side shifter, with 4-in. movement each side of center, eliminates unnecessary positioning of the truck for exact spotting of rolls, according to the manufacturer.

The clamp arms can be removed and replaced with forks, so that the truck can be used for regular pallet work. The curved portions of the arms which come in contact with the rolls are 14 in. wide by 24 in. high. The complete unit weighs 1,000 lb.

The method of hose take-up is unique, it is claimed, in that it keeps the hose inside the mast channels, which eliminates breakage from the hose catching on pallet loads or other objects which might protrude into the aisles. *Lamson Mobilift Corp., Portland, Ore.*

HI-PRODUCTION Chipper Knives



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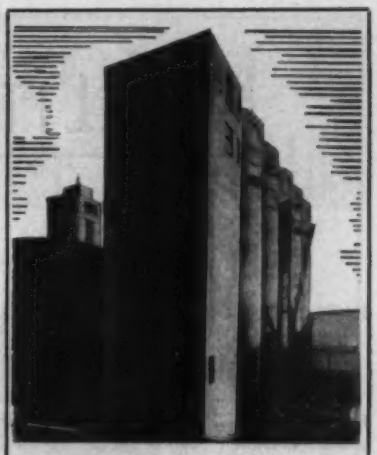

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NEW LITERATURE

Books

INSPECTION OF DIGESTERS (Monograph No. 12). Published by the Technical Association of the Pulp and Paper Industry, 155 East 44th St., New York, N. Y. 6 x 9. 183 pages. Paper-bound. Prepared under the direction of the Digester Corrosion Subcommittee of the TAPPI Chemical Engineering Committee, this monograph differs somewhat from the earlier monographs in that essentially it is a field manual for inspectors of alkaline pulping digesters in service. The main objective of this monograph is to make available to digester owners a tool for routine maintenance and safety control of a hazardous piece of equipment. Procedures also have been offered for the mill personnel to study their own corrosion problems at a local level.

This manual presents a definition of the functions of a digester inspector and a description of recommended practices for carrying them out. The plan of the monograph is to analyze the inspection activity into parts in a chronological order, as they would naturally occur in the course of a complete cycle of digester inspection. The introductory chapter takes a bird's-eye view of the complete scope of an inspector's job and discusses the administrative aspects of an inspection program. The second chapter outlines the case history data on any individual digester.

The next group of four chapters covers the actual digester inspection technique. Chapter V, Visual Inspection, gives detailed instructions on what to look for. This is followed in Chapter VI by a discussion of the technical aspects of wall thickness measurements, particularly the non-destructive types. Two important auxiliary aspects of the digester installation—the digester fittings and closely associated pressure piping, and over-pressure safety systems—are considered in separate chapters.

Necessary technical information on repair of kraft digesters is found in Chapter IX. The two final chapters are devoted to interpretation of results and preparation of reports.

An appendix with pertinent background information and supplementary reference material adds to the usefulness of the monograph. It includes sections on photographing digester corrosion (with numerous illustrations), report forms and checklists, calculation of allowable pressures, errors in thickness measurement, operating conditions and practices affecting corrosion, examples of corrosion in metals for digesters and auxiliary methods of corrosion testing, inspection time studies, and digester construction materials and manufacture.

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Booklets and Pamphlets

THE EVOLUTION OF PAPERMAKERS' FELTS (Vol. II, No. 6). Published by F. C. Huyck & Sons, Rensselaer, N. Y. 6 x 9¼. 16 pages. This booklet which traces the evolution of papermakers' felts includes numerous diagrams and photographs.

TECHNICAL NOTES, NOS. 414 TO 419. Published by Lake States Forest Experiment Station, University Farm, St. Paul 1, Minn. 8 x 10½. Topics covered in these one and two-page papers are as follows: The Jack-Pine Budworm in Michigan, 1953; Production Indexes for Rough Forest Products — Lake States; Mortality From Fire in Jack Pine Stands; Cull in Sugar Maple Increased by Breakage of Large Limbs during Logging; Aspen Makes Up Nearly One-Half of 1953 Pulpwood Cut in Lake States, and Fire Occurrence: Periodicity of Good and Bad Years.

PROGRESS IN DEVELOPMENT OF EFFICIENT TURPENTINING METHODS. (Station Paper No. 32) By Albert G. Snow, Jr. Published by Southeastern Forest Experiment Station, Asheville, N. C. 8 x 10½. 35 pages. The results of studies of various modifications of potentially practical methods of turpentining, using bark chipping and acid treatment, carried on at Lake City, Fla. Research Center for the past five years, are given in this paper; and the relative merits of each method are discussed. Some of the important conclusions of these studies from 1947 through 1951 are listed.

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Analysis of Alkalies. Advertising & Sales Promotion Dept. (PI), Solvay Process Div., Allied Chemical & Dye Corp., 61 Broadway, New York 6, N. Y.—Technical and Engineering Service Bulletin No. 9, "The Analysis of Alkalies" (Fourth Edition), retains the scope and arrangement of the previous editions, but many new and up-to-date additions have been made.

Centrifugal Chemical Pumps. Goulds Pumps, Inc., Dept. PI, Seneca Falls, N. Y.—Bulletin 725.4 covers the new Fig. 3715 line of centrifugal pumps designed especially for the chemical, food and other process industries.

Centrifugal Castings. Shenango-Penn Mold Co., Dept. PI, Dover, Ohio.—Bulletins 150 and 151 cover centrifugally cast parts for use as bushings, liners, sleeves, rings, rolls or virtually any symmetrical or annular shape. Bulletin No. 150 deals with non-ferrous parts in manganese and aluminum bronzes, red bronzes, brass, Monel metal, and special alloys. Bulletin 151 covers ferrous parts of Meehanite metal, Ni-Resist and special iron alloys.

Synthetic Resins, Pentaerythritol, Plasticizers, & Nonionics. Hercules Powder Co., Synthetics Dept. (PI), 934 Market St., Wilmington 99, Del.—Synthetic resins, pentaerythritol, plasticizers and nonionic surface-active agents are listed, with characterizing data, in this bulletin. Certain key properties are shown.

Welding of Stainless Tubing & Pipe. Babcock & Wilcox Co., Dept. PI, Beaver Falls, Pa.—Folder TDC 162 discusses welding of stainless tubular products.

Tools of Automation. Reliance Electric & Engineering Co., Dept. PI, 1076 Ivanhoe Rd., Cleveland 10, Ohio—This new booklet, entitled "Tools of Automation," contains sections on application engineering, choosing the right motor for the job, adjustable-speed "V*S" drives and electronic controls and regulators. A final section includes captioned photographs which graphically illustrate automation at work in many industries.

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No. 1 Washables	3.00 to 3.25
No. 1 Light Silesias	7.50 to 8.00
No. 1 Light Prints	5.75 to 6.00
Light Flannelettes	7.75 to 8.25
Cottonades	3.75 to 4.00
Blue Overalls	7.50 to 8.00
Blue Cheviots	7.00 to 7.50
Canton Flannels, Bleached	11.00 to 11.25
Canton Flannels, Unbleached	11.00 to 11.25
Osnaburg Cuttings	9.50 to 10.00
Underwear Cuttings, Bleached	14.50 to 15.50
Underwear Cuttings, Unbleached	14.50 to 15.50
Khaki Cuttings—	
Sun Tan	6.75 to 7.00
Mixed	3.75 to 4.00
Linen Cuttings—	
American	7.25 to 7.75
White	13.00 to 14.00
Grey	13.00 to 14.00

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Quotations to consuming mills, dollars per hundred pounds, f.o.b. New York, follow:

Roofing	per cwt.
No. 1	1.10 to 1.20
No. 2	.80 to .90
No. 3 and 4	.60 to .70
Twos and Blues—	
Repacked	2.25 to 2.50
Thirds and Blues—	
Repacked	2.00 to 2.25
Miscellaneous	1.65 to 1.85
Whites, No. 1—	
Repacked	3.75 to 4.00
Miscellaneous	3.25 to 3.50
Whites, No. 2—	
Repacked	2.75 to 3.00
Miscellaneous	2.25 to 2.50

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ex dock New York City

NEW RAGS

per cwt.

Nominal:
New Dark Cuttings
New Mixed Cuttings
New Light Silesias
Light Flannelettes
Unbleached Cuttings
New White Cuttings
New Light Oxfords
New Light Prints

RAGS (Foreign)

ex dock New York City

OLD RAGS

per cwt.

Nominal:
No. 1 White Linens
No. 2 White Linens
No. 3 White Linens
No. 4 White Linens
No. 1 White Cottons
No. 2 White Cottons
No. 3 White Cottons
No. 4 White Cottons
Extra Light Prints
Ord. Light Prints
Med. Light Prints
Dutch Blue Cottons
French Blue Cottons
French Blue Linens
Checks and Blues
Linsey Garments
Dark Cottons
Old Shoppers

ROPE and BAGGING

f.o.b. and ex dock New York City

	per cwt.
Gunny No. 1—	
Foreign	4.25 to 4.50
Domestic	4.25 to 4.50
Wool Tares—	
Light	4.50 to 4.75
Heavy	4.75 to 5.00
No. 1 Scrap Bagging	3.75 to 4.00
Manila Rope—	
No. 1 large	5.25 to 5.50
No. 1 small	4.25 to 4.50
Sisal Rope—	
No. 1 large	4.75 to 5.00
No. 1 small	4.25 to 4.50
New Burlap Cuttings	5.75 to 6.25
Jute Threads—	
Foreign (Nom.)	6.00 to 6.25
Domestic	6.25 to 6.50
Strings—	
No. 1 sisal	4.75 to 5.00
No. 2 sisal	4.25 to 4.50
Soft jute	4.75 to 5.00
Mixed	2.50 to 2.75

WASTE PAPER

The following are quotations, dollars per ton, for No. 1 packing f.o.b. New York:

Shavings—	per ton
Hard White Env. Cuts.	120.00 to 130.00
Hard White No. 1	100.00 to 105.00
Soft White, one-cut	75.00 to 80.00
Soft White, No. 1	60.00 to 65.00
Coated Soft	40.00 to 45.00
Fly Leaf No. 1	25.00 to 30.00
Fly Leaf, Woody No. 1	25.00 to 30.00
No. 2 Mixed Col. Woody	20.00 to 25.00
Flat Stock—	
No. 1 Heavy Books and Magazines, Repacked	22.00 to 24.00
Mixed Books	16.00 to 17.00
Ledger Stock—	
No. 1 White	55.00 to 60.00
No. 1 Mixed (Colored)	35.00 to 37.50
Manilas—	
New Env. Cuttings	70.00 to 75.00
New Cuts, One-Cut—	
Extra Manilas	19.00 to 20.00
Manila Tab Cards, Free of Ground Wood	80.00 to 85.00
Colored Tab Cards	50.00 to 55.00
Kraft—	
New Envelope Cuttings	65.00 to 70.00
Tripled Sorted No. 1 100%	40.00 to 45.00
No. 1 Old Assorted	27.50 to 32.50
News—	
White Blank	65.00 to 70.00
Overissue	22.00—
No. 1 Folded	16.00—
Old Corrugated Containers	22.00—
New Jute Corrugated Cuts	27.00—
Mill Wrappers	17.00—
Box Board Chips	11.00—
No. 1 Mixed Paper	10.00—

CHEMICALS

f.o.b. shipping point

Alum (Papermakers)—	
Lump, cwt.	5.05—
Ground, cwt.	4.30—
Powdered, cwt.	5.10—
Blanc Fixe—	
Pulp, bulk, ton	100.00—
Dry, barrels	105.00—
Bleaching Powder—	
Drums, cwt	5.00 to 6.00
Casein (Domestic Standard)	
20-30 mesh (bags), lb.	
80-100 mesh (bags), lb.	27.00—
Argentine, lb.	22.00 to 22.50
China Clay—	
Domestic Filler	
Bulk (mine) ton	10.50 to 16.00
Domestic Coating	
Bulk (mine) ton	17.00 to 25.00
Imported (ship side)	
Bulk (lump) ton	20.00 to 30.00
Chlorine—	
Tank cars (wks) cwt.	2.25—
Gelatine (silicon), lb.	1.25 to 1.35
Glyc. (C.P.) drums, lb.	.29½ to .30
Litharge, powd. bbl. lb.	.16½ to .17

MARKET QUOTATIONS

Rosin (Gum)—	New York, per 100 lbs.
E	9.20—
F	9.20—
G	9.20—
WW	9.40—
Rosin (Wood), carlots, F.O.B. South	5.75—
Salt Cake—	
Dom. bulk (wks) ton	24.00 to 26.00
Imp. bulks on dock— (Atl. ports) ton (Nom.)	22.00—
Soda Ash—	
Bulk (works) cwt.	1.35—
Paper bags, cwt.	1.70—
Soda (Caustic)—	
Solid drums, cwt.	3.85 to 4.50
Ground and flake, drums, cwt.	4.25 to 5.00
Sodium Silicate—	
60 deg. 55 gal. drums, (works) cwt.	1.60 to 1.70
40 deg. 55 gal. drums, (works), cwt.	1.35 to 1.40
Starch—	
Pearl, 140 lb. bags, cwt.	6.30—
Pearl, barrels, cwt.	6.30—
Paper (Hp.) bags, cwt.	6.30—
Powdered, barrels, cwt.	6.60—
Sulphur (Crude) (Mine) bulk, long ton	26.50 to 28.00
Talc—	
Dom. 100 lb. bags (mine) ton	25.00 to 28.00
Canadian	35.00 to 45.00
Titanium Dioxide—	
Barium Pig. bbls., lb.	.22½ to .23
Calcium Pig. bbls., lb.	.22½ to .23
Zinc Sulphide, bbls., lb.	11.50 to 12.00

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Quotations on domestic and Canadian wood pulp, dollars per short air dry ton, delivered consuming mills including basic freight allowances, follow:

Bleached Sulphite	140.00—
Bleached Sulphite, Canadian	140.00—
Unbleached Sulphite	120.00—
Unbleached Sulphite, Canadian	120.00—
Bleached Soda	140.00—
Bleached Soda, Canadian	140.00—
Kraft, Bleached	145.00—
Kraft, Bleach., Southern	142.50 to 150.00
Kraft, Bleach., Canadian	145.00 to 150.00
Kraft, Unbleached, Northern	132.50—
Kraft, Unbleached, Southern	95.00 to 105.00
Kraft, Unbleached, Canadian	100.00 to 125.00
Kraft, Semi-Bleached, Southern	140.00—
Sulphite Screenings	72.50—
Sulphate Screenings	67.50—
Groundwood	82.50 to 87.50

Quotations on imported wood pulp, dollars per short ton, on dock American Atlantic ports with varying freight allowances, follow:

Bleached Sulphite, Swedish	142.50—
Bleached Sulphite, Norwegian, freight allowed	135.00 to 140.00
Bleached Sulphite, Finnish, freight allowed	140.00—
Unbleached Sulphite, Swedish	125.00—
Unbleached Sulphite, Finnish, freight allowed	120.00 to 125.00
Kraft, Unbleached, Swedish, freight allowed	110.00 to 115.00
Kraft, Unbleached, Finnish, freight allowed	110.00 to 140.00
Kraft, Bleached, Swedish, on dock	142.50 to 147.50
Kraft, Bleached, Norwegian	

PAPER

Quotations are mill quotations New York City

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Prices per ton, delivered in New York, 10 tons or more:

Plain chip	75.00—
News vat lined chip	80.00—
Filled news	75.00—
Solid news	80.00—
White vat lined chip	125.00—
Chip tube and can stock	100.00—
Single manila lined chip	140.00—
Single jute lined chip	125.00—
Kraft liner	117.50 to 122.50

White patent coated:

.020	155.00—
.018	157.50—
.016	160.00—

Book Paper f.o.b. New York— per cwt.

Machine coated, two sides

70 lb. No. 2 enamel, 25x 4 cases $17.25
38-500, trimmed 4 sides. Carloads $16.80
45 lb. enamel, 25x38-500, 4 cases $13.05
trimmed 4 sides. Carloads $12.10

Uncoated

55 lb. No. 2 offset, 25x38 4 cases $14.80
500, trimmed 4 sides. Carloads $13.85
50 lb. A Grade English
Finish, 25x38-500, un- 4 cases $14.05
trimmed. Carloads $13.10
20 lb. envelope, 17x22-500, untrimmed. Carloads $12.40
16 lb. tablet, 17x22-500. Carloads $11.35

Rag Content Bond—

(White, 5,000 to 10,000 lbs., basis 16 lb.)

100% rag	58.80—
75% rag	45.45—
50% rag	36.20—
25% rag	29.70—

Rag Content Ledger—

(White, 5,000 to 10,000 lbs.)

100% rag	58.80—
75% rag	45.45—
50% rag	36.20—
25% rag	29.70—

Sulphite Bond—

(White, 5,000 to 10,000 lbs., basis 16 lb.)

No. 1	19.85—
No. 2	19.15—
No. 4	17.45—

Sulphite Ledger—

(White, 5,000 to 10,000 lbs.)

No. 1	20.20—
No. 2	19.50—
No. 4	17.90—

News delivered in New York— per ton

Rolls, Standard (Contract)	125.00 to 130.00
Rolls (Spot)	(Nominal)
Sheets	133.00—

Tissues (Carlots) f.o.b. New York— per ream

White No. 1	1.75—
White No. 2	1.35—
Bleached Anti-Tarnish	2.20—
Colored	2.00—
Anti-Tarnish Kraft	1.85—
Manila	2.00—
Napkins, semi-crepe (12½ lb. to M shts.) per cs.	.90—
Napkins, full crepe and embossed (12½ lb. to M shts.) per cs.	.90—
Toilet, Bleached (M shts.) per cs.	9.35—
Toilet, Unbleached (M shts.) per cs.	7.90—

Towels f.o.b. New York— per case

Bleached	6.80—
Unbleached	5.90—

Wrappings (Kraft) f.o.b. New York— per cwt.

Standard wrapping	8.00—
Butchers, counter rolls	8.50—
Standard bag, mill rolls	7.75—
Shipping sack, mill rolls	8.00—
Gumming, mill rolls	8.25—
Asphalting, mill rolls	8.00—
Envelope, mill rolls	9.50—

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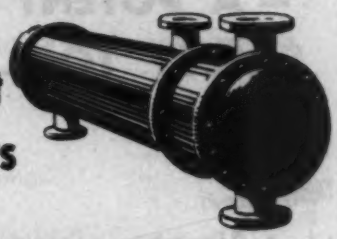

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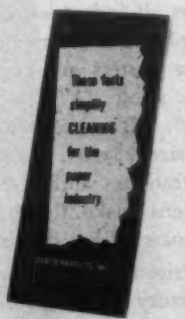

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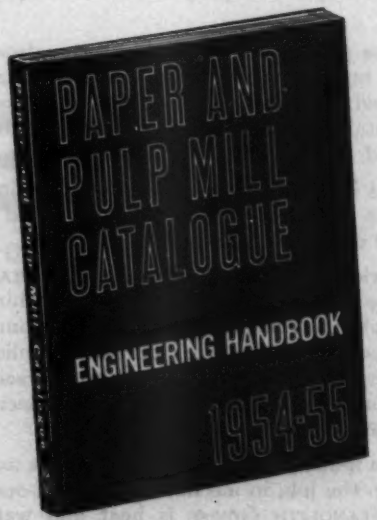

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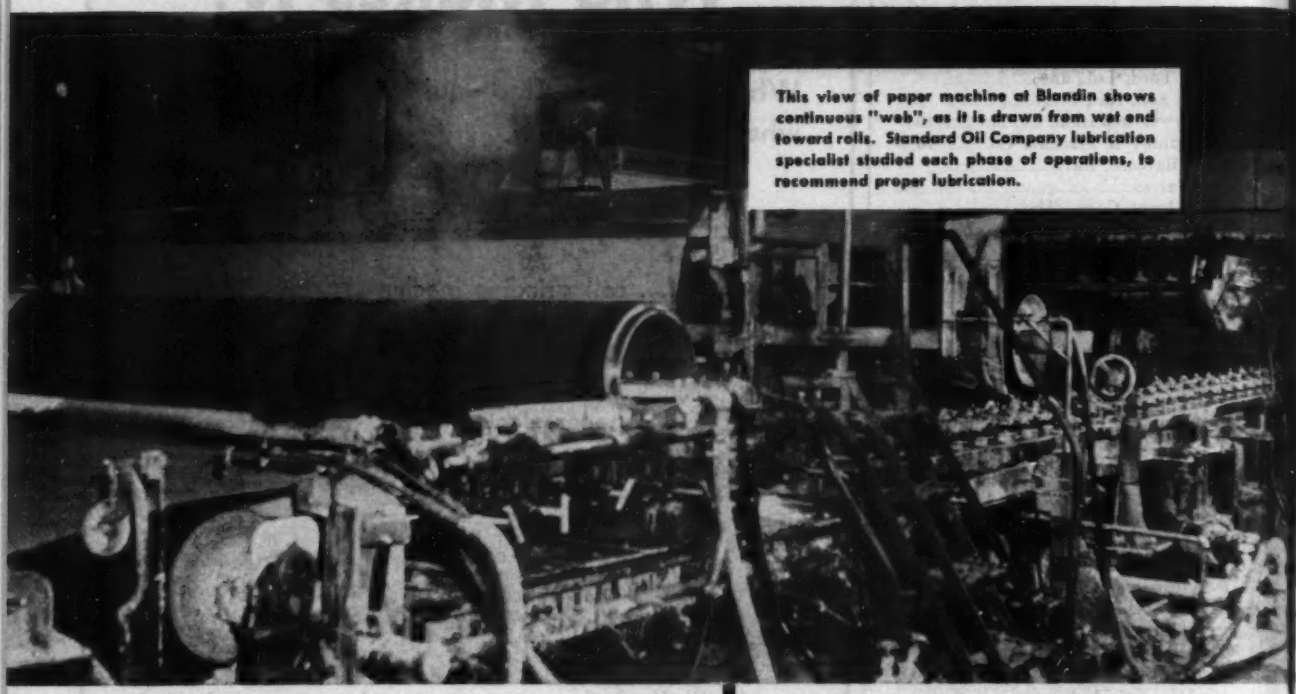
STANOLITH GREASE *overcomes trouble spot, keeps paper rolling at* BLANDIN



This view of paper machine at Blandin shows continuous "web", as it is drawn from wet end toward rolls. Standard Oil Company lubrication specialist studied each phase of operations, to recommend proper lubrication.

STANOLITH Grease aided the solving of a rough lubrication problem at Blandin Paper Company in Grand Rapids, Minnesota.

A bottleneck on the paper making machines threatened production at this hustling paper plant four years ago. The trouble occurred near the beginning of the process, where the pulp contains up to 99% water. At this point, bearings are greeted by a shower of water and stock.

Greases were quickly lost, literally washed away. Bearings were ruined early in life. Not only had greases failed in their duty but they caused paper staining.

A Standard Oil lubrication specialist recommended STANOLITH Grease for use on the wet end of the paper machine. It did such a good job that Blandin maintenance personnel put this multi-purpose grease to work on other applications, too. Now, except when open gear and brick greases are required, STANOLITH serves the entire plant, replacing a wide number of single-duty products.

STANOLITH is truly a multi-purpose grease. It may be used almost anywhere on the job, in mechanical or hand-operated dispensers. STANOLITH Grease is heat and water resistant. It will reduce grease inventories, eliminate waste and prevent costly application errors. Find out more about how STANOLITH Grease can help you do many tough lubrication jobs with just *one grease!* In the Midwest call your nearby Standard Oil lubrication specialist. Or contact Standard Oil Company, 910 South Michigan Avenue, Chicago 80, Illinois.

Blandin maintenance man, Fred Harwood (left), and I. A. Westerlund, Standard Oil lubrication specialist, inspect a table roll bearing. This is just one of many places in the plant where STANOLITH Grease provides top-efficiency lubrication.

I. A. Westerlund is a graduate of the University of Minnesota with an engineering degree. He is also a graduate of Standard's Sales Engineering School, and makes good use of his training in providing technical service to customers. He's been doing this for 14 years. His customers find this experience and training pay off *for them.*

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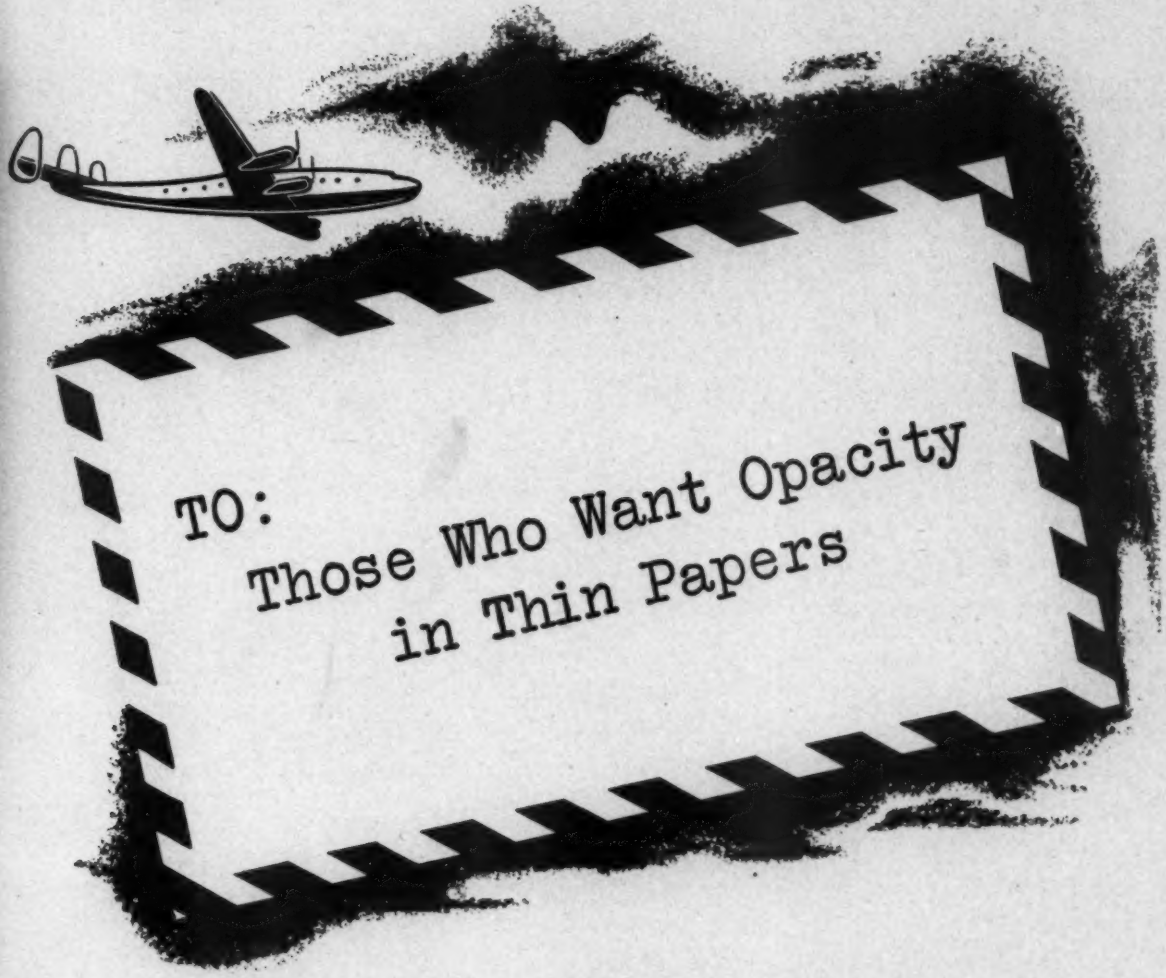

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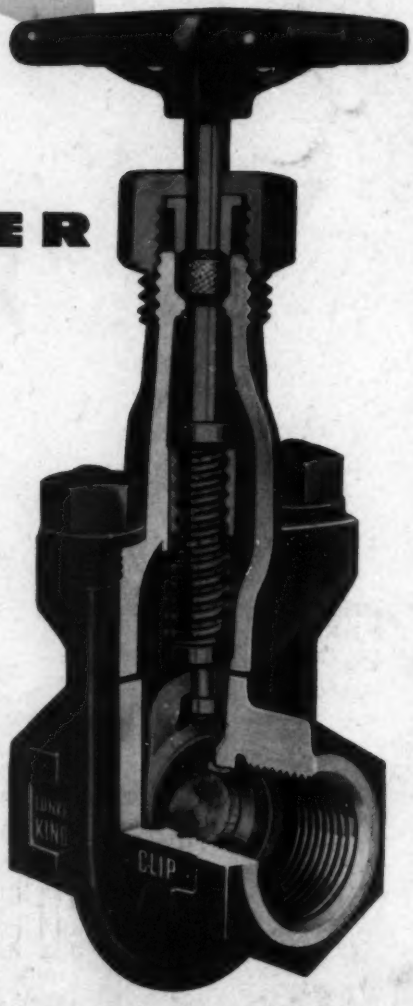

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